THE EFFECT OF COOPERATIVE AND COMPETITIVE GAMES WITH LEARNING DISABLED ADOLESCENTS ON ARITHMETIC PERFORMANCE AND ON-TASK BEHAVIOR

BY

SHELIA YVETTE SMALLEY

A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1982

To

Juanita M. Smalley

ACKNOWLEDGEMENTS

With deepest appreciation, the author would like to take this opportunity to acknowledge some of the many people who have contributed to the completion of this dissertation.

My doctoral committee chairman, Cecil D. Mercer, has been of great support to me. His wisdom, insight, and scholarly suggestions have enriched my professional development, and his friendship will be cherished forever.

My committee member Bob Algozzine and dear friend Alicia Schmitt have been tolerant and patient as my research consultants. They helped me to smile when the light was dim.

My department chairperson and committee member, Catherine V. Morsink, has opened many doors, enabling me to experience many educational opportunities. Her warmth and belief in me is greatly appreciated.

My committee members James Longstreth and Myron Cunningham each have contributed much to the evolution of this dissertation and my beginning teacher years. They knew me when . . .

My dear friend Leila Cantara frequently advised me throughout my career at the University of Florida and typed this dissertation. I extend love, thanks, and friendship forever.

My father, William T. Smalley, has been a source of love and inspiration throughout my life. I could not have accomplished my goals without him.

Most of all, I wish to dedicate this dissertation to my wonderful mother, Juanita M. Smalley. Her love, patience, understanding, and guidance have been with me from day one. All that I am and ever hope to be is due in part to her.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS iii

ABSTRACT viii

CHAPTER I INTRODUCTION 1

Purpose 2

  Problem 3

  Variables 3

  Questions 3

  Delimitation 3

  Limitations 4

  Significance 4

  Definition of Terms 4

Summary 7

CHAPTER II REVIEW OF THE LITERATURE 8

The Use of Instructional Games in the Classroom 9

  Advantages and Disadvantages of Games 11

  Using Arithmetic Games in the Classroom 13

  Summary of Related Literature on Use of Games in the Classroom 18

Goal Structures 19

  Cooperative Goal Structures 21

  Competitive Goal Structures 32

Summary of Related Literature 38
CHAPTER III METHODS AND PROCEDURES 39
The Sample 39
The Instrument 40
Procedures 41
  Group Assignment 41
  Intervention for the Experimental Groups 42
  The Control Group 45
  Observation of On-Task Behavior 46
  Arithmetic Posttest 47
Design and Data Analysis 48
CHAPTER IV RESULTS 51
Arithmetic Performance 51
On-Task Behavior 54
Arithmetic Performance and On-Task Behavior 61
Specific Error Patterns Analysis 64
Summary 66
CHAPTER V LIMITATIONS, IMPLICATIONS, AND CONCLUSIONS 68
Limitations 69
Implications 71
  Arithmetic Performance 71
  On-Task Behavior 89
  Achievement and On-Task Behavior 90
  Relationship of Present Findings to Previous Research . . 93
Suggestions for Future Research 95
Summary 97

APPENDIX A SPECIFIC VERBAL INSTRUCTIONS GIVEN TO STUDENTS UNDER THE THREE TYPES OF LEARNING ACTIVITIES . . . 99

B ALACHUA COUNTY PROCEDURES 104

C COMPUTATIONAL SKILLS SURVEY 113

D SKILL ANALYSIS FOR COMPUTATIONAL SKILLS SURVEY FORMS A AND B 119

E OBSERVATION FORM 120

F PROCEDURES USED IN STUDYING COOPERATIVE, COMPETITIVE, AND INDIVIDUALISTIC GOAL STRUCTURES . 121

G DESCRIPTIVE DATA 128

REFERENCES 129

BIOGRAPHICAL SKETCH 136

Abstract of Dissertation Presented to the Graduate
Council of the University of Florida in Partial Fulfillment
of the Requirements for the Degree of Doctor of Philosophy

THE EFFECT OF COOPERATIVE AND COMPETITIVE GAMES WITH LEARNING DISABLED ADOLESCENTS ON ARITHMETIC PERFORMANCE AND ON-TASK BEHAVIOR

By

Shelia Yvette Smalley

December, 1982

Chairman: Cecil D. Mercer
Major Department: Special Education

The purpose of this study was to investigate the effects of cooperative games, competitive games, and worksheets on the arithmetic performance and on-task behavior of learning disabled (LD) adolescents. Also, the relationship between arithmetic performance and time on-task was examined across the three treatments.

From the sample of 36 students, 12 were assigned to each of the three treatment conditions: cooperative, competitive, and worksheets (control group).

The basic design of the study was a posttest, with an arithmetic pretest as covariate. The performance scores were analyzed with analysis of covariance (ANCOVA) and the Bonferroni post hoc procedure. The on-task scores were analyzed with ANCOVA and the Johnson-Neyman technique. The correlation between arithmetic scores and on-task behavior was analyzed using the Pearson product-moment. All statistical procedures were tested at the .05 level of significance.

Results of the data analysis indicate that worksheets were significantly better than cooperative. Competitive was not significantly different from worksheets, which suggests that they are equally effective. Although competitive was not significantly different from cooperative at .05, the probability that the difference occurred by chance between these groups was at .0543, favoring competitive. There was a significant difference in time on-task between the cooperative and the competitive groups, favoring competitive for higher ability students and cooperative for lower ability students; and there was a significant difference in time on-task between the cooperative and the worksheet groups, favoring worksheets for higher ability students and cooperative for lower ability students. The on-task comparisons between the groups must be cautiously interpreted because much of the data had to be extrapolated. There was no significant relationship between arithmetic performance and on-task behavior for the overall group. However, it was significant for the worksheet group ($r = .68$, $p \leq .05$).

The results suggest there are variations in performance and time on-task in various learning activities. Thus, in planning for the instructional needs of LD adolescents, this study suggests that worksheets seem to work better overall for arithmetic performance. For on-task behavior, there appears to be an interaction between learning activity and ability level of the student.

CHAPTER I

INTRODUCTION

Because of the wide range of learning problems in arithmetic it is surprising to note that, until recently, relatively little attention had been paid to this significant problem area (Bartel, 1978). Bartel suggests that perhaps this has been the case because so much time and effort have gone into the attempt to make students literate. Perhaps it also reflects the fact that many children with essentially no understanding of arithmetic principles are able to hide behind superficial rote ability in computation.

As Mercer (1979) pointed out, there is still a significant void in the literature pertaining to the arithmetic needs of the learning disabled (LD) student. Moreover, there has been little interest in conducting research in learning disabilities and arithmetic at the secondary level (Marsh, Gearheart, & Gearheart, 1978). The secondary level learning disabled student should be expected to develop at least functional abilities in arithmetic that would ensure competencies for application in most occupations and in consumer needs. This should be a high priority for learning disabilities specialists, and becomes a crucial issue in determining the future of secondary level learning disabled students (Marsh et al., 1978).

Although the educationally handicapped adolescent is maturing sexually, socially, and vocationally, he is nonetheless impeded by an inability to learn in traditional educational settings (Beattie, 1981). There is much need for individual attention. The literature reports comparatively fewer activities, programs, tests, methods, and materials for instructing children with arithmetical difficulties than in other academic areas (i.e., music, science, etc.) (Bartel, 1978).

Purpose

One of the primary academic disabilities of learning disabled adolescents is in arithmetic (Mercer, 1979). Few efforts have been aimed at examining the teaching of arithmetic to handicapped learners (Brown, 1975; Johnson, 1979; Marsh et al., 1978; Mercer, 1979). Several authors recommend the use of educational games for providing practice of arithmetic skills (Coble & Brady, 1977; Gordon, 1970; Kennedy & Michon, 1973; Lovinger, 1979; Smith & Backman, 1975). According to Beattie (1981) games are significantly better than drills (e.g., worksheets) in both achievement and on-task behavior across learning disabled and educable mentally retarded populations. The purpose of this study was to investigate the efficacy of cooperative and competitive games in remediating the arithmetic deficits of learning disabled adolescents.

Problem

What is the effect of cooperative and competitive games with learning disabled adolescents on arithmetic performance and on-task behavior?

Variables

The dependent variables in this study are scores on an arithmetic test and time on-task. The independent variable is the type of learning activity, with three levels: (1) cooperative games, (2) competitive games, and (3) traditional worksheet activities.

Questions

The study was designed to investigate the following questions.

1. Is there a difference in the arithmetic scores among learning disabled adolescents who participate in cooperative games, competitive games, and traditional worksheet learning activities?
2. Is there a difference in the amount of time on-task among learning disabled adolescents who participate in cooperative games, competitive games, and traditional worksheet learning activities?
3. Is there a relationship between performance and time on-task for learning disabled adolescents who participate in cooperative games, competitive games, and traditional worksheet learning activities?

Delimitation

The population of subjects was selected from Howard Bishop Middle School and Westwood Middle School, Alachua County, Gainesville, Florida. Only youngsters in grade levels six through eight participated in the study.

Limitations

This study is limited to adolescents in the subject population (i.e., middle school learning disabled adolescents). Because of the possible educational, social, financial, and cultural differences between this group and other possible groups, they should not be viewed as a representative sample of students in the remainder of the United States.

A further limitation of this study centers on the fact that the ratio of boys to girls used in this study does not represent the proportion of learning disabled students in learning disabled classrooms. All of these factors limit the generalizability to other proportions of boys and girls, age groups and other exceptional children populations.

Significance

There is not enough information reported in the literature concerning the teaching of arithmetic to learning disabled learners (Brown, 1975; Mercer, 1979). Consequently, research efforts need to be continued to yield information applicable to the teaching of arithmetic to learning disabled students.

Definition of Terms

A *game* may be defined as any simulated contest (play) among adversaries (players) operating under constraints (rules) for an objective (winning) (Gordon, 1970).

For the purposes of this study a *cooperative game* is a method of academic intervention which is characterized by cooperative interaction of students in a game-like setting (Beattie, 1981; Humphrey, 1969). Students must perceive that they can obtain their goal if, and only if, the other students with whom they are linked obtain their goals (Johnson & Johnson, 1978). Specific verbal instructions on cooperative playing were given to the subjects (see Appendix A).

For the purposes of this study a competitive game is a method of academic intervention which is characterized by competitive interaction of students in a game-like setting (Beattie, 1981; Humphrey, 1969). Students must perceive that they can obtain their goals if, and only if, the other students with whom they are linked fail to obtain their goals (Johnson & Johnson, 1978). Specific verbal instructions on competitive playing were given to the subjects (see Appendix A).

For the purposes of this study a traditional worksheet is a method of teaching based exclusively on repetition (Beattie, 1981). Worksheets were used in this study. The worksheets could be completed independently of teacher supervision with the student working alone at his desk. Specific verbal instructions on working with worksheets were given to the subjects (see Appendix A).

The learning disabled adolescent is that student, 12 through 16 years of age, enrolled in a learning disabilities (LD) classroom in the Alachua County Schools, as defined by the Bureau of Education of Exceptional Students (BEES), Florida Statutes number 228.041, the Department of Education, State of Florida, Alachua County (1981). (See Appendix B for specific procedures used in Alachua County.)

The specific learning disabled student is one who exhibits a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, reading, talking, writing, spelling, or arithmetic. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, to emotional disturbance, or to any environmental deprivation. This definition is given by the Bureau of Education of Exceptional Students (BEES), Florida Statutes number 228.041, the Department of Education, State of Florida, Alachua County (1981). (See Appendix B for specific procedures used in Alachua County.)

For the purposes of this study a general definition of on-task behavior is determined when one or all of the following occur(s): the subject is looking at the relevant assigned task stimulus (Beattie, 1981; Rose, 1977), putting pencil to paper, directing eye gaze toward the task, and/or raising hand to ask questions which turn out to be relevant (Cobb, 1972; Forness, 1973; Lay, 1969; Sparks, 1981; Stodolsky, 1979).

For the purposes of this study a general definition of off-task behavior is determined when the subject's eyes are not attending to the assigned work (Beattie, 1981; Rose, 1977). Motor off-task behavior consists of any out of seat behavior, doodling, directing eye gaze away from the task, and pencil not to paper in conjunction with off-task gaze (Cobb, 1972; Cooper, 1981; Forness, 1973; Nottelmann & Hill, 1977; Sparks, 1981).

Summary

Learning disabled adolescents frequently manifest an academic disability in arithmetic skills. Little information exists concerning techniques which may be helpful in remediating these arithmetic deficits. The effectiveness of cooperative games, competitive games, and traditional worksheet activities as they relate to learning disabled adolescents' performance on arithmetic and time on-task was compared. The relationship between performance on arithmetic and time on-task for learning disabled adolescents who participate in cooperative games, competitive games, and traditional worksheet learning activities was also investigated.

CHAPTER II

REVIEW OF THE LITERATURE

This review examines the literature concerning the use of instructional games in the classroom. Surprisingly, the researcher found a shortage of literature regarding the use of cooperative and competitive games to remediate arithmetic deficits. Cooperative and competitive games are discussed in the literature in relation to goal structures. Goal structure specifies the type of goal interdependence existing among students as they work toward goal accomplishment. The literature supports three goal structures that teachers may use during instruction, i.e., cooperative, competitive, and individualistic. In order to maintain relevance to the present study, the researcher addressed only cooperative and competitive goal structures.

The literature reviewed in this section was located by several methods. An ERIC literature search was conducted. Additionally, the Current Index of Journals in Education and the Education Index were examined from 1969 to the present date. Key words used in these searches were arithmetic, children (exceptional), competitive, cooperative, educational games, exceptional children, games, and learning disabilities.

Also, the card catalog was used to find relevant textbooks on the above key words. After relevant textbooks had been secured, the bibliography of each of the relevant chapters was examined to identify additional sources.

References selected for inclusion met one of the following criteria:

1. The reference was dated subsequent to 1969.
2. The reference was published in a refereed journal.
3. The reference was based on Johnson and Johnson's (1975) guidelines for goal structures (cooperative and competitive). Each of the goal structures is defined in its respective area.

The Use of Instructional Games in the Classroom

Games are being used extensively to instruct students. Zieler (1968) indicates there are several hundred games on a wide variety of skills available for use in classrooms. These games range from word games for preschoolers to simulations of complex political, social, and economic processes for high school and college students (Gordon, 1970). Inbar and Stoll (1970) report an extensive review of several theoretical perspectives of converging reasons for the potential value and use of self-motivating activities as a teaching medium. "Games are cut off from serious consequences of everyday life, for the activities within them can be enjoyed for their own sake" (p. 97).

There is a scarcity of research on whether or not particular games have learning effects. Humphrey's (1965, 1966) studies indicate that students exposed to games involving verbal and number cues display greater learning than those exposed to the same material by means of traditional workbook procedures. Allen, Allen, and Ross (1970) indicate that mathematical games produce greater amounts of learning in a shorter time when compared to traditional classroom methods.

Other literature on games suggests that the time devoted to playing a game produces an amount of learning equal to the same time spent in classroom learning (Anderson, 1970). In this situation, learning refers to scores on tests typical of those given in a course. There is also evidence that games induce individual skills or traits that are not obtained through traditional teaching methods, e.g., decision-making (Anderson, 1970), sense of efficacy (Boocock & Coleman, 1966).

In addition, Boocock's (1969) finding of a nonsignificant or inconsistent relationship between performance in a game and academic performance has repeatedly occurred. Inbar and Stoll (1970) say this means "games apparently mobilize intellectual skills unrelated to verbal skills" (p. 59). Also one of the components of a good game is chance. Consequently, the low and high ability students in a class have an equal chance of winning. The implication is that "games would be especially valuable for the underachiever or the non-verbal or cognitively deprived student" (p. 58).

Inbar and Stoll (1970) offer three reasons why caution must be used in drawing implications from studies on games. In much of the work,

1. it has been somewhat ad hoc, and investigators generally do not relate their choice of measures to a general theory of games and daily living;
2. the criteria of learning are of unknown validity and reliability;
3. there is a need for replication of findings with a wide sampling of games and students.

All problems have not been solved regarding the use of games in the classroom. The technique will probably be refined in the future. Very precise evaluation procedures have yet to be developed to prove beyond an objective doubt that games, in certain circumstances, teach more effectively than other known methods (Gordon, 1970).

Obviously, the available data are not extensive enough to carve out a clearcut profile with regard to learning through games (Humphrey, 1969). It is apparent that existing literature stimulates many questions, and research needs are numerous.

Advantages and Disadvantages of Games

Clark (1978) notes that although the effectiveness of educational games has been demonstrated, few secondary teachers have adopted the technique as an essential component of the curriculum. As she examines the benefits attributed to participation in games, she mentions improvement in IQ scores (Allen, Allen, & Ross, 1970), race relations

(DeVries & Slavin, 1975), peer tutoring (Hamblin, Buckholdt, Ferritor, Kozloff, & Blackwell, 1971), attitudes (Boocock & Schild, 1968; DeVries, 1976; Lee & O'Leary, 1971; Slavin, 1977), and academic achievement (Boocock & Schild, 1968; Braskamp & Hodgetts, 1971; Carlson, 1969; Charles & Stadsklev, 1973; Fisher, 1976; Fletcher, 1971, Heitzman, 1974; Teffel, 1976). A number of these studies have identified low-ability students as the primary beneficiaries, since different learning rates are minimized among students during gaming. Moreover, Slavin indicates that games encourage peer interaction while individualized instruction may result in unintentional social barriers among students.

When Clark examined why games have not consistently produced outcomes superior to those of traditional teaching, she mentions the three suggestions given by DeVries: " (1) inadequate integration of games into the class-reward structure and instructional goals; (2) introduction of games merely as 'filler' materials; and (3) exclusive replacement of traditional learning methods with game strategies" (p. 109). Edwards and DeVries (1972) note that the effectiveness of games has been ascribed to their motivational potential, feedback, and reinforcement for academic skills, and the opportunity they give teachers to tutor individually.

Cruickshank and Telfer (1980) offer the following advantages of the use of games.

1. They guarantee participants real life experiences.
2. They allow participants to solve difficult problems.

3. They provide transfer from the training situation.
4. They provide immediate feedback on performance.
5. They are sensitive to time consideration.
6. They enable participants to make discussions and experience consequences.
7. They are safe.
8. They are fun.

Cruickshank and Telfer (1980) offer some disadvantages.

1. Teachers are relatively unfamiliar with games.
2. They require a lot of time.
3. They often focus on peripheral skills rather than basic skills.
4. They are less accessible to the teacher than other learning materials.
5. They can be expensive.

Seemingly, the only conclusion that can be drawn here is that there are both considerable benefits and several problems associated with the use of games in the classroom. However, research evidence should be used to assist judgment.

Using Arithmetic Games in the Classroom

"Games are fun, and it is important to have fun" (Keer, 1974, p. 18). When children are playing arithmetic games in school, fun is associated with a topic that is not always considered to be enjoyable. It is impossible and undesirable to organize the majority of arithmetic instruction around games, but it is sometimes possible to develop games in such a way that they complement the regular arithmetic instruction and thereby justify more classroom time.

It is recognized that arithmetic learning is accomplished via meaningful experiences and practical applications. However, the skills of computation need to be nurtured by a variety of systematic practice and drill (Johnson, 1979). Johnson indicates the following:

> The total approach to learning arithmetic uses meaning, practice and application. The meaning of numbers, the understanding of a process, the arithmetical structure involved precedes the practice. Practice then is part of the learning process which builds accuracy, efficiency and retention. Purposeful practice in the right amount, at the right time, will help build the arithmetical competence that business, science, industry and education are demanding. Arithmetic games are ideally suited for a systematic program of practice. (p. 5)

The success of an arithmetic game, like any other material or technique, is highly dependent on how it is used (Johnson, 1979). If an arithmetic game is to serve a real function, the following considerations, offered by Johnson, should be remembered.

1. Select game materials that relate to the needs of the class and the learning of important arithmetic skills and concepts.
2. Use games at the appropriate time over a short period of time so that students do not lose interest (i.e., when skills are being taught or reviewed, "filler" for free time, etc.)
3. Organize the game situation around maximum involvement of all students. Avoid embarrassment, the choosing of team members by captains, and negative comments. Allow

students to compete when appropriate, with each working on material according to his ability.

4. Plan and organize the game carefully so that the informality and stimulating setting do not defeat its purpose. Students should be taught to play games by rules, in an organized fashion as with any other material. Expect good work as you would with regular classwork.
5. Stress the responsibility of learning the arithmetic concepts and skills and use follow-up activities to emphasize this responsibility. Teachers should evaluate the results by asking themselves whether the game promoted the desired learning.

In summary, instructional games are only one means for helping students learn arithmetic. However, games can serve a variety of functions in the classroom (Johnson, 1979), such as

1. building desirable attitudes towards arithmetic,
2. providing for individual differences,
3. developing concepts,
4. making practice periods pleasant and successful,
5. developing perceptual abilities,
6. providing opportunities for logical thinking or problem solving.

Teachers should choose games carefully to reinforce the arithmetic skills students are learning and their use should be planned, not for play only (Hoffman, 1974).

Learning disabilities and arithmetic. Although limited literature exists concerning arithmetic problems and remediation, large numbers of children and adolescents continue to experience failure in this area of the curriculum (Wallace & McLoughlin, 1979). Students with learning disabilities in arithmetic have not been as thoroughly studied as students with other learning disabilities. Koppitz (1971) reports that 88 percent of the children referred to the learning disabilities program in her study were one to three years below the expected grade level in arithmetic computation. Likewise, 52 percent of the learning disabled population used in Brenton and Gilmore's (1976) study had educationally significant low scores in arithmetic.

Despite the diversity of information provided by people working in the field, and the limited information available, some general factors have been related to learning disabilities in arithmetic. Students with learning disabilities in arithmetic may be having difficulty because of ineffective instruction (Bartel, 1978; Otto, McMenemy, & Smith, 1973), which probably accounts for more cases of problems in arithmetic than any other factor. Wallace and McLoughlin term it "poor teaching," where there is a lack of sequential skill development and the use of inappropriate teaching materials.
Other general reasons could be those of difficulties in abstract or symbolic thinking (Bartel, 1978), lack of learning readiness (Wallace & McLoughlin, 1979; Otto et al., 1973), inappropriate emphasis (emphasis on rote learning of isolated skills and facts) (Wallace &

McLoughlin, 1979), reading and memory disorders (Bartel, 1978; Johnson & Myklebust, 1976), poor attitudes and anxiety (Bartel, 1978) or interest and motivation (Wallace & McLoughlin, 1979). These disorders often place a learning disabled adolescent two to three grade levels behind his/her expectancy age (Beattie, 1981). Teachers must be sensitive to these general deficits and the types of instructional methods and materials they use with arithmetic learning disabled students.

Games and the learning disabled. The learning disabled student who has arithmetic deficits may exhibit deficits in perception, directionality, abstract or logical thinking, memory and reading (Bartel, 1978). Teachers must be sensitive to these deficits and instructional techniques used with the learning disabled (Beattie, 1981).

Games give students a variety of ways to deal with a topic, allow active participation in the learning process, provide repeated exposure without becoming tiresome, and enrich students' backgrounds (Kennedy & Michon, 1973). The learning disabled student has traditionally been given textbooks, flashcards, worksheets or ditto approaches to gain practice (Beattie, 1981; Kennedy & Michon, 1973). These authors note that while these may be used successfully with some students, learning disabled students are likely to become bored and are not likely to benefit from practice.

Kennedy and Michon (1973) state that games can be used along with other materials to stimulate practice sessions and heighten student interest and motivation in maintaining skills and concepts.

Disguising a drill in a game format may well foster greater participation of students (Beattie, 1981). In a game there is no guarantee that "the smartest" students will win. There is no monopolizing of activity by "the smartest," since everybody participates at the same time (Gordon, 1970). In other words, all students have a realistic chance of success. Additionally, Gordon points out that students do not have to worry about grades when playing games; while teachers may have problems with this notion, it removes inhibition from the student. He also mentions that games offer more leadership roles than are generally available in other activities. These differences become apparent to students, and from there on they are able to devote their attention to the activity at hand without worrying about the cues and signals, the penalties and rewards that usually demand attention. Because it is only a game, students cannot lose much. Consequently, with the use of games, teachers are able to provide students practice in the basic skills as well as the areas of deficits as mentioned earlier.

Summary of Related Literature on Use of Games in the Classroom

The limited research available concerning the use of games in the classroom clearly indicates a need for further research and exploration. There needs to be a closer examination of the advantages and disadvantages of the use of games in the classroom and their potential as instructional alternatives. More specifically, there is a scarcity of literature on arithmetic and remediation needs of the learning disabled student.

Whatever the technique used to remediate arithmetic deficits with the learning disabled, one must keep in mind the kinds of general problems that may be present. Games are only one means of helping students with arithmetic needs, and should not be viewed as a panacea for educational problems. Unquestionably, learning arithmetic is nurtured by a variety of systematic practices and drills. Arithmetic games are ideally suited for such purposes. Games, used at the right time, for the right purpose in the right way, can be an excellent vehicle for reinforcing the arithmetic skills students are learning.

Goal Structures

A goal is a desired state of future affairs (e.g., a completion of an arithmetic assignment) and goal structure specifies the type of goal interdependence present among students as they work toward goal accomplishment (Johnson & Johnson, 1978). The Johnsons point out that teachers can structure student learning goals so that students are in small groups helping each other become proficient in assigned work, in a win-lose situation to determine who is best, or on their own learning individualistically (see Figure 1).

There are three goal structures that teachers may use during instruction (Deutsch, 1962; Johnson & Johnson, 1975). These goal structures are

1. cooperative (positive goal interdependence)
2. competitive (negative goal interdependence)
3. individualistic (no goal interdependence)

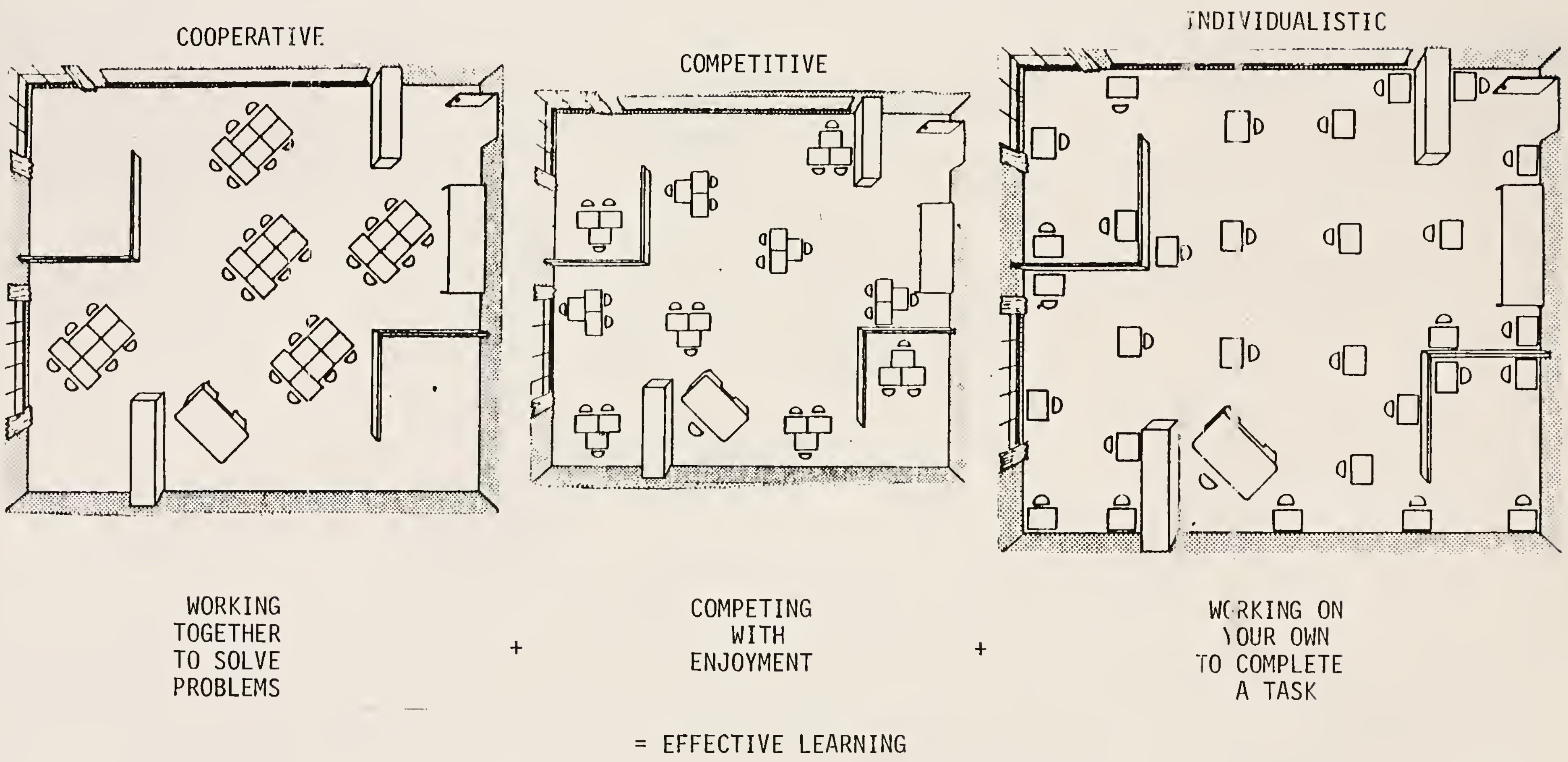

Figure 1

Goal Structures

Source: Adapted from Johnson, D. W., & Johnson, R. Learning together and alone: Cooperative, competitive and individualization. Englewood Cliffs, NJ: Prentice-Hall, 1975, p. x and 74-76.

However, for the purposes of maintaining relevance to this study, the researcher addressed only cooperative and competitive goal structures.

Cooperative Goal Structures

In a cooperative goal structure "students perceive that they can reach their goal if, and only if, the other students with whom they are linked reach their goals" (Johnson & Johnson, 1975, p. 3). For example, this situation would occur when a group of students are working together to answer a set of comprehension questions after reading a story, presenting a skit for a required theme requested by the teacher, watching a movie or play together and brainstorming afterwards to present a report to the class.

This review of related literature is presented in terms of (a) academic achievement, (b) student attitudes about cooperation and competition and attitudes toward schooling, and (c) using the cooperative goal structure appropriately.

Academic achievement. Johnson and Johnson and their students have conducted five studies examining the relative effects of cooperative, competitive, and individualistic goal structures on achievement and a variety of school related tasks (academic achievement was one of the dependent variables, along with social-affective measures) (Johnson & Johnson, 1975; Sharan, 1980). Each of these studies indicates superior achievement results for the cooperative as compared to a competitive and an individualistic learning method. The studies focused on students in grades one through six, three of the studies were with white middle class students (Johnson, Johnson, Johnson, & Anderson, 1976; Johnson, Johnson, & Scott, 1978; Johnson, Johnson, & Skon, 1979). In the cooperative condition, in each study, subjects were instructed to work together as a group, completing one paper or set of papers as a group, with all members sharing materials and ideas and helping each other. They were instructed to make sure each member was involved and agreed on the answers. The teacher praised and rewarded the groups on the basis of each group's achievement (Johnson, Johnson, & Skon, 1979; Johnson, Johnson, & Tauer, 1979; Johnson, Skon, & Johnson, 1980). In each of these studies, except Johnson, Skon, and Johnson (1980), the task required primarily math and verbal drill-review, or perceptual-level functioning in geometry, rather than eliciting and assessing higher level cognitive skills (Sharan, 1980). In the studies that compared cooperative with individualistic conditions, Johnson, Johnson, Johnson, and Anderson (1976) and Johnson, Johnson, and Scott (1978), the tasks were without structured peer tutoring, and the cooperative team condition was still more effective than the individualistic condition.

In the Johnson, Skon, and Johnson (1980) study, which was pointed out above as being the only one of the five studies conducted that did not require subjects to complete a single collective task, some very important results were reported. These researchers used a population of 45 first graders from middle and working class backgrounds. Fifteen students, selected by a stratified random sampling procedure, were assigned to each of the cooperative, competitive, and individualistic learning structures. Also, each condition employed three different learning tasks involving categorizing and retrieval of 12 nouns; a spatial-reasoning problem consisting of a diagram containing an ambiguous number of triangles; and verbal problem-solving consisting of 10 math story problems. All students participated in six instructional sessions of 60 minutes each. Prior to the study all of the students had participated in all three of the learning methods, and were familiar with the procedures of each condition.

The findings indicate that students in the cooperative condition outperformed students in the other two conditions on free recall, spontaneous retrieval (noun memory task), and verbal problem-solving (mathematics). On spatial-reasoning, students from cooperative and competitive conditions did better than those in the individualistic condition. Students in the cooperative condition used superior strategies and were more aware of using this approach than the students in the competitive and the individualistic condition. The cooperative group perceived higher levels of peer support and encouragement for learning. The former group also displayed superior logic on the verbal reasoning task. Finally, high ability students in the cooperative condition consistently achieved more than did the high ability students in the competitive and individualistic conditions. Table 1 presents a review of studies of cooperative, competitive, and individualistic goal structures on academic achievement.

Table 1

Studies of Cooperative, Competitive, and Individualistic Goal Structures on Academic Achievement

Author(s)	Population/ Assignment	Comparisons	Duration	Measures	Results
Johnson, Johnson, & Skon (1979)	White middle-class 1st graders Cooperative, N=36 Competitive, N=14 Individualistic, N=14 28 males, 36 females Age range 5.11-7.10 Stratified random assignment (high, medium, low in reading and math ability in each condition, approx. = % of male-females in each condition	Determine the type of task (6 different) on which coop., comp., and indiv. goal structures will promote high achievement	Six instructional sessions of 40 minutes each	1. Achievement test or each task 2. Subjects' perceptions of tasks as being easy or hard (questionnaire)	On all 6 tasks, subjects in coop. condition achieved higher than subjects indiv. on math and reading drill review, sequencing and visual sorting according to attributes task. On triangle identification tasks subjects in indiv. and coop. achieved higher than subjects in comp. In general subjects in coop. felt tasks were easier than subjects in comp. and indiv.

Table 1—Continued

Author(s)	Population/ Assignment	Comparisons	Duration	Measures	Results
Johnson, Johnson, & Tauer (1979)	Nongraded 4th,5th and 6th grade sections, middle and lower middle-class backgrounds. N=32 males and 37 females. Random assignment (23 in each condition, nearly equal male-females)	Coop. vs. comp. vs. indiv. learning situations on self-esteem	5 days	1. Student attitudes toward perceived acceptance by teacher, peers and oneself. (attitude questionnaires) 2. Achievement test	Cooperation promoted stronger perceptions of teacher academic and personal support than indiv., stronger perceptions of peer academic and personal support than comp. or indiv.; higher achievement than comp. or indiv. Competition resulted in higher achievement and stronger perceptions of teacher academic and personal support than indiv. No significant difference among conditions on the measure of self-acceptance.
Johnson, Skon, & Johnson (1980)	1st graders, middle and working class background. N=27 males, 18 females. Stratified random sampling (same as first study)	1. Coop. vs. indiv. conditions on problem-solving performance. 2. Three different learning tasks.	6 instructional sessions of 60 minutes each	1. Achievement on each task, quality of strategy used on each perception of peer support for learning (achievement test and questionnaire)	On all 3 tasks, subjects in coop. achieved higher than subjects in indiv. and on 2 of 3 tasks subjects achieved higher than comp. No significant difference between comp. and indiv. condition.

Table 1—Continued

Author(s)	Population/ Assignment	Comparisons	Duration	Measures	Results
					Subjects in coop. used higher quality strategies on 3 tasks than comp. and indiv. and perceived higher levels of peer support and encouragement for learning. High ability students in coop. generally achieved higher than subjects in the other 2 conditions.
Johnson, Johnson, Johnson, & Anderson (1976)	5th grade, white working class background. N=30. Matched on achievement in lang. arts, randomly assigned to groups. Coop. N=9 boys, 7 girls. Indiv. N=7 boys, 7 girls	Coop. vs. indiv. learning on student ability to take the affective perspective of others, altruism, attitudes toward classroom life, and enrichment	45-60 minutes per day for 17 days	1. Achievement tests 2. Interviews to measure altruistic behavior and affective perspective taking ability 2. Questionnaire on attitude of learning (Minnesota School Affective Assessment)	Coop. compared to indiv. learning results in greater ability to take the affective perspective of others, more altruism, more positive attitudes toward classroom life, and higher achievement.

Table 1—Continued

Author(s)	Population/ Assignment	Comparisons	Duration	Measures	Results
Johnson, Johnson, & Scott (1978)	Advanced math class of 5th and 6th graders, white. N=30 boys and girls in upper-middle class school. Coop. N=16, 9 boys, 7 girls. Indiv. N=14, 3 boys, 11 girls. Randomly divided (controlling for math ability)	Coop. vs. indiv. conditions on attitude toward heterogeneity among peers; self-esteem; attitude toward teacher peers; conflict; internal locus of control; achievement	1 hour daily for 50 days	1. Daily log of teacher observations 2. Teacher interviews (individual and coop. groups) to determine subjects' perception to their respective goal structures 3. Sociogram completed by subjects before and after study 4. Achievement test 5. Postexperimental questionnaire (Minnesota School Affective Achievement) 6. Subjects interviewed by 2 university students to measure attitudes toward ethnic and sex role heterogeneity among peers.	Cooperative learning promoted more positive attitudes toward heterogeneity among peers; higher self-esteem; more positive attitudes toward the teacher, fellow co-operators, and conflict; more internal locus of control; and higher daily achievement

Student attitudes about cooperation and competition and attitudes toward schooling. There is a considerable amount of research that indicates cooperative learning conditions, when compared to competitive ones, promote more positive relationships among students and school personnel, positive relationships among students, motivation to do well as students, willingness to get involved in learning activities, positive self-attitudes, and a variety of other affective and cognitive learning outcomes including higher achievement (Johnson & Ahlgren, 1976; Johnson, Johnson, & Anderson, 1978). Furthermore, there is evidence that the majority of students perceive school as being competitively structured, but prefer cooperative experiences (Johnson & Johnson, 1976), that American students are more competitive than are children from other countries and become more competitive the longer they are in school or the older they become (Johnson & Johnson, 1975). In short, this research implies that while cooperation among students is more facilitative of education, competition is more frequently emphasized.

Johnson and Ahlgren (1976) submitted correlational analyses to determine the relationships between scales measuring student attitudes toward cooperation and competition and scales measuring their attitudes toward (a) relationships with school personnel, (b) motivation to learn, (c) relationships with other students, (d) involvement in learning activities, (e) personal worth as a student, and (f) restraints on student behavior. Over 2,400 students in grades two to 12 participated in the study.

Data on student attitudes were obtained with the Minnesota School Affective Assessment (MSAA). The MSAA consists of two parts; a series of five-level semantic differential questions and a series of four-level true-false items. Findings of (b), (c), and (d) above are of particular interest to the present study and will be discussed below.

Findings regarding being motivated to learn reveal student cooperativeness is positively related to students' seeing themselves as being intrinsically motivated to learn. The more cooperative students' attitudes also indicate confidence in their own efforts as determinants of their own school success. They also value getting good grades, being good students, and believing that ideas, feelings and learning new ideas are significant and positive. This study also indicates that competitiveness is positively related to students' seeing themselves as being extrinsically motivated in elementary and junior high schools. The more competitive students' attitudes, however, are somewhat related to intrinsic motivation, to being good students, and to getting good grades in senior high school.

Findings concerning students' relationships with other students indicate that cooperativeness is positively related to wanting to listen to, help, and do schoolwork with other students. It is also positively related to attitudes toward students who are not as smart as or smarter than oneself, and being liked by other students. Cooperative attitudes are negatively related to wanting to work alone. On the other hand, competitiveness tends to be related positively to liking to work alone, although this relationship decreases in high school.

Finally, findings for student involvement in learning activities indicate that cooperativeness is fairly consistently related positively to students' seeing themselves as expressing their ideas and feelings in large and small classes and listening to the teacher. There is a relation between competitiveness and beliefs that one is not able to express oneself in class, is not listened to by teachers, and is not able to ask or answer questions in class but it decreases and becomes insignificant in senior high school.

Johnson, Johnson, and Anderson (1978) conducted a similar study with 8,100 students in grades four to 12, measuring attitudes toward cooperation, competition, and individualism and attitudes toward the same as (a) through (f) listed above. Findings corroborate those found in the above study.

Using the cooperative goal structure appropriately. From a practical perspective, Johnson and Johnson (1975, 1978) recommend that the cooperative goal structure be used much more frequently in instructional situations. It should be used most of the time in school and should provide the overall context for learning. The conditions under which it is effective and desirable are whenever it is important for students to be motivated, involved, and attending; whenever it is important to master, retain, and apply knowledge and skills; and whenever positive student attitudes are desired. If the task is very simple and can be completed without assistance from someone else, then, cooperative goal structuring should not be used. Supplemental use of competitive and individualistic goal structures would be more appropriate in the situation of a simple task.

Johnson and Johnson further contend that most teachers know how to implement competitive and individualistic goal structures within instructional activities. However, the teacher's role in implementing cooperative structured learning is often ambiguous. The teacher's role in cooperative instruction is reviewed in this section.

Essentially, cooperative teaching involves assigning a group goal, such as producing a single product, and rewarding every group member on the basis of the group product on a fixed set of standards. However, teaching a cooperative lesson involves more than setting up a cooperative goal structure. A brief summary of Johnson and Johnson's tips on the teacher's role in cooperative instruction follows:

1. Specify the instructional objectives as much as possible.
2. Select the optimal group size based on the age of students and resources needed to complete the lesson.
3. Assign students to groups (maximizing heterogeneity), or randomly assign to ensure a good mixture, or allow students to choose groups, or group by ability.
4. Arrange the classroom in cluster groups to avoid other student interference and maximize group participation. Circles are best. Avoid long tables.
5. Provide the appropriate materials and distribute them among the group.

6. Explain the task and the cooperative goal structure.
7. Observe the student-student interaction.
8. Intervene as a consultant.
9. Evaluate the group products, using a criterion-referenced evaluation system.

Summary of research on cooperative goal structure. When the task involves free recall, spontaneous retrieval, and verbal problem solving, the research studies of Johnson and Johnson indicate that a cooperative learning condition results in higher achievement than competitive and individualistic learning conditions. There is considerable evidence that cooperative learning conditions, when compared with competitive ones, have a more positive relationship with students' being motivated to learn, their relationship with other students, and their involvement in learning activities. It has been recommended that the cooperative goal structure be used in the vast majority of instructional situations, unless the task is very simple and can be completed without someone assisting. If the task is very simple, then the competitive or individualistic goal structures are recommended.

Competitive Goal Structures

Students in a competitive goal structure "perceive that they can reach their goals if, and only if, the other students with whom they are linked fail to reach their goals" (Johnson & Johnson, 1978, p. 3). An example of this situation is a math quiz where students are rank ordered from the student with the most correct answers to the student with the least number of correct responses. Another example is a situation of a class spelling contest where all of the students in the class start off in the contest and the contest continues until one student outperforms all of the other students.

This review of related literature is presented in terms of academic achievement and using the competitive goal structure appropriately.

Academic achievement. Miller and Hamblin (1963) reviewed 24 studies concerning cooperative and competitive goal structures. They found that in 14 competitive learning resulted in higher achievement than did cooperative learning, while in 10 cooperative learning was demonstrated as more effective. Michaels (1977) selected 10 studies to review on three goal structures and found that in seven competitive learning promoted higher achievement than did cooperative or individualistic learning.

The research indicates that competition may be superior to cooperative or individualistic goal structures when a task is a simple drill activity or when sheer quantity of work is desired on a mechanical or skill-oriented task that requires little if any help from another person (Johnson & Johnson, 1975, 1978). Clayton (1964) spent a week in a typewriting classroom where he implemented an element of competition involving both speed and control. He used three categories of competitive drill; namely, self-competition, individual competition, and group competition. Findings indicate the competitive elements should not be overemphasized to the point of forgetting the purpose of the main task and that of developing speed and accuracy. When administering competitive drill, keep things simple so that students' time will not be wasted in explaining procedures and reporting results. Students seem to prefer competitive drills where short bursts of speed and drills for accuracy are involved. The self-competition method seems to be most appropriate when the drill material and procedure could be used with any of the three methods of competition. The utilization of a variety of competitive procedures is more feasible than the use and probable overuse of one type of competitive procedure to the exclusion of all others. Students tend to respond much better to competitive drills when such drills are not overemphasized in the typewriting classroom. Clifford (1971) found individual competition to strengthen performance more effectively than both individual and group reward contingencies. Individual competition was more effective than individual reward contingencies in strengthening students' performances on digit-letter substitution problems.

Deutsch (1953) conducted an experiment to demonstrate the effects of a "competitive situation" and a "cooperative situation" upon achievement, cohesion, and other matters. The experiment went roughly as follows. Students in the industrial psychology classes were given hypothetical human relations problems to discuss and solve. There were two different reward structures: (a) In some classes, each member was told that he and his four peers would each be ranked from one to five according to the contribution of each to the discussion and to the problem's solution. At the end of the semester, each student's grade was based on the average of his ranks through the semester. (b) In five other classes, each class was told that it would be ranked as a class from one to five on the basis of its solution to the problems. At the end of the semester, the ranks of the five classes were averaged, and the members of each class graded according to their class's average rank. Therefore, in condition (a), each student was being compared with his classmates; in condition (b), each class was being compared with other classes.

Deutsch's findings all favor condition (b). The solutions to the problems were better among the classes in condition (b); the class members hindered one another in the discussion under condition (a), but aided one another under condition (b); the feeling of class members toward one another was more positive under condition (b) than under condition (a).

The structure of reward under condition (a) included individuals compared with others in the same group and rewarded relative to these others. This produced competitiveness between individuals. On the other hand, in condition (b), groups were compared with other groups and rewarded relative to the other groups. This produced competitiveness between groups. Yet although there was competition in both situations, the second kind of competition produced very different consequences from the first; in achievement, in the group members' feelings toward one another, in the unity of the group. As long as the group was competing against other groups, one member's achievement benefitted, rather than lowered, the position of other members of his group; consequently, the group's response to his achievement was positive rather than negative.

When the competition was between individuals, the fact that one individual's achievement lowered the position of other group members produced interference with one person's efforts by other members, though the interference was perhaps unconscious and subtle. When the competition was between groups, there was support of one person's efforts by others in the group.

Using the competitive goal structure approach appropriately. Although many research studies indicate that cooperative learning conditions are more effective than competitive ones, there are conditions under which competitive learning conditions may be used profitably by the teacher. "If students can compete for fun and enjoyment, win or lose, competitive drills are an effective change of pace in the classroom (Johnson & Johnson, 1978, p. 11). Johnson and Johnson state that competition is effective in increasing student performance on a simple drill activity or a speed-related task when sheer quantity of work is desired on a project that requires minimal or no assistance from another person: spelling, vocabulary, math drills, writing practice, word recognition, recall of facts and dates, hand-eye coordination, and athletic contests. In other words, when the instructional goals are to review, drill, or achieve quantity on a simple task, the teacher may wish to use competition. A brief summary of Johnson and Johnson's tips follows.

1. Competition can be productively used when it is not important whether one wins or loses. Otherwise, high levels of anxiety appear and other destructive consequences as well.

2. All students should perceive that they have an equal chance of winning. Add the elements of chance (i.e., skip a turn, go back one space, etc.). Students will not compete if they perceive they do not have an equal chance of winning.
3. Make sure specific rules, procedures, and answers are clear. Otherwise, students will increase their anxiety, which ruins competition.
4. All students need to be able to observe the progress of their competitors during the competition, so that they can determine whether they are ahead or behind.

Summary of research on competitive goal structure. When the instructional goals are to review, drill, or achieve quantity on a simple task, the Johnsons' research indicates that a competitive learning condition more than a cooperative or an individualistic condition results in increased student performance. It has been recommended that the competitive goal structure be used when it is not important whether one wins or loses, when all students perceive they have an equal chance to win, when clearly defined rules, procedures and answers are communicated at the beginning, and where students can evaluate their skills.

Summary of Related Literature

The scarcity of literature available concerning the use of games as an instructional alternative in the classroom clearly indicates a need for further research. Specifically, there is limited literature on arithmetic and remediation needs of the learning disabled student. While arithmetic games are ideally suited for systematic practice and drill, there is no literature on cooperative and competitive games reinforcing and remediating arithmetic learning.

However, there is considerable literature on cooperative and competitive goal structures, which can obviously be related to games. There is disagreement as to the relative effects of the two goal structures on achievement and productivity. Some research clearly indicates that cooperative learning conditions result in higher achievement, while other research indicates that competitive learning conditions result in higher achievement. There is evidence that both cooperative and competitive conditions have a positive relationship to student attitudes about cooperation and competition and attitudes toward schooling. And both goal structures are effective, when used with the right instructional goal, in the right way. Yet there is a need to look at cooperative and competitive games to remediate basic math facts.

CHAPTER III

METHODS AND PROCEDURES

Chapter III presents the methods and procedures of this study. This chapter is organized into four major sections: (a) a description of the sample, (b) a description of the instrument, (c) a description of the procedures, which includes group assignment, intervention for the experimental groups, the control group, observation of on-task and the posttest, and (d) the design and data analysis.

The Sample

The research for this study was conducted in Alachua County Public School System, Gainesville, Florida. Alachua County is located in north central Florida.

The subjects consisted of 36 sixth through eighth grade learning disabled adolescents enrolled in exceptional student education (ESE) classes in mathematics. The criteria used to determine specific learning disabilities are listed in Appendix B. Subjects' ages ranged from 11 to 15, and subjects' scores on the screening instrument (Pretest, Computational Skills Survey, Form A, Brigance, 1981) were rank ordered, then subjects were assigned to the three learning activities. Twelve subjects were assigned to participate in cooperative games, 12 to competitive games, and 12 worked with traditional worksheets. The groups consisted of a similar distribution of boys and girls, and grade levels (six through eight). Sixty-four percent of the subjects were obtained from one school and 36 percent from another.

The Instrument

The instrument selected for use in this study was a modified version of the Computational Skills Survey, a test from the Brigance Diagnostic Inventory of Essential Skills. The Brigance was developed by Albert H. Brigance (1981), designed specifically for secondary students with special needs. The Computational Skills Survey has two forms, A and B, and is comprised of 25 items on each form (see Appendix C). The researcher added an additional 25 items to each form so that there were two arithmetic problems to represent each skill analysis objective (see Appendix D). The purpose of the computational assessment is to determine which basic computational skills (i.e., addition, subtraction, multiplication, and division) the student has mastered well and which skills should be taught. The materials have been designed so that they can be used either for individuals or groups or both, with the student giving his or her responses in writing.

The Brigance Inventory of Essential Skills, a criterion-referenced test, was field tested and evaluated by more than 100 participants representing 55 programs in 26 states and two sites in Canada, Langley and Vancouver. Seventy-six of 101 criterion-referenced tests (excluding "Oral Reading" and "Reading Comprehension") were rated by at least 95 percent of the personnel as having validity for assessing the respective skill sequence. Only five of 101 criterion-referenced tests were rated by more than 10 percent of the personnel as not having adequate validity (Brigance, 1981). Reliability information is not reported for the Inventory.

Procedures

Group Assignment

The independent variable in this study was the type of learning activity which had three levels: (1) cooperative games (experimental group A), (2) competitive games (experimental group B), and (3) the traditional worksheet (control group). Thirty-six learning disabled adolescents with disabilities in arithmetic, from grades six to eight constituted the sample for this study. The selection of students for placement in either the experimental or control groups was conducted in the following manner. The students were administered the Computational Skills Survey, form A, which was used as a screening device (pretest) to determine students with arithmetic disabilities in the four operational areas of arithmetic (i.e., addition, subtraction, multiplication, and division). Those students who scored less than 80 percent on this test constituted the pool of subjects. Subjects were ranked on their test scores from highest to lowest by class periods. There were not more than six subjects attending ESE math classes per period (first through seventh) in either school. Because two treatment conditions required groups of children, subjects were assigned to treatments based on the number of students attending ESE math classes each period. Also, students with similar math ability were grouped together. Twelve subjects were assigned to the cooperative games group, 12 to the competitive games group, and 12 to the traditional worksheet group.

Intervention for the Experimental Groups

This study implemented cooperative and competitive conditions in as constructive and effective way possible, based on the procedures used in a series of 12 studies by Johnson and Johnson (1978), with a few modifications in the competitive games group condition (see Appendix F). The researcher trained a teacher to facilitate cooperative game, competitive game, and traditional worksheet learning activities. The researcher served as the second teacher. Each day of the study the teacher met with the researcher to review plans for the presentation of the learning activities so that all relevant procedures were strictly followed. The teachers rotated in the two schools weekly, and on the last week they rotated schools every other day for an even number of days. Each teacher taught each of the learning activities daily.

The study focused on remediating arithmetic disabilities. Each day during the arithmetic period the subjects went to their assigned areas of the ESE classroom. The total arithmetic class time was 45 minutes. The first five minutes were used by the teachers to read written directions for explaining the tasks and learning conditions, so that instructions were consistent between teachers. The daily activities (games and worksheets) and their response sheets were distributed. The total instructional time was 25 minutes. After the instructional period, the last 15 minutes were used to collect and score response sheets, with the number wrong on each response sheet taken as the group score or individual score.

The work assignments were based on each subject's instructional level in one of the four operational areas. This was determined by the consistency of arithmetic problems incorrect on the screening test in rank order of addition, subtraction, multiplication, and division. In other words, if a subject had most of the addition and subtraction problems correct on the screening test but consistently missed multiplication problems, he received instruction in multiplication. When a subject mastered (85 percent) the operational area he was initially given instruction in, he was given instruction in the next respective area.

The intervention technique used for experimental group A consisted of cooperative games to remediate arithmetic disabilities. The games used emphasized the appropriate arithmetic content for each subject. In the cooperative game activity the subjects were assigned to four groups: four groups of three members each. Subjects were instructed to work together as a group, completing one daily response sheet as a group, with all members sharing materials and ideas, making sure all members were involved and understood how to derive each answer, seeking help and clarification from fellow group members rather than the teacher. Subjects in each group were required to sign the paper, indicating that they understood how to solve each problem. Each day the teacher randomly selected one subject from each group to explain how to solve a problem as a check on whether or not subjects were following instructions and making sure everyone understood how to solve each problem. All members of the cooperative game group received a group score. No competition between groups or between persons was structured into the evaluation. The teacher praised and rewarded the groups on the basis of each group's achievement.

The intervention technique used for experimental group B consisted of competitive games to remediate arithmetic disabilities. These games emphasized the appropriate arithmetic content for each subject. The competitive game activity was structured to maximize the likelihood that the constructive and appropriate use of competition would be demonstrated. Subjects were assigned to four clusters: four clusters of three subjects each. To ensure that all subjects in this learning activity believed that they had an equal chance of winning, the clusters competed for 1st, 2nd, and 3rd place. After each instructional session, subjects were informed of the results. Each cluster member's gameboard was identical. To add to the element of chance, surprise factors such as go to jail, skip a space, work one extra math problem were added to the gameboards. This was designed to maintain subjects' perceptions that each had a reasonable chance of winning. Although each cluster represented a similar level of ability, when mastery is achieved in the four operational areas, speed is equivocal (Mercer & Mercer, 1981). While subjects competed, they were instructed to work alone, attempt to win in their clusters, and seek help and clarification from the teacher when they needed to. Subjects were seated with others in their cluster at a large table. Although subjects worked alone, they were instructed to be aware of their competitors' progress by noticing when they raised their hands to signal completion of a task. As subjects raised their hands, the teacher collected the response sheets and numbered them in the order received. The response sheets were scored individually to determine 1st, 2nd, and 3rd place within each cluster. The winners were determined by who finished first with the greatest amount of accuracy. The teacher praised and rewarded on the basis of the individual performance of the winner in each cluster.

The Control Group

The control group consisted of subjects working with traditional worksheets (dittos). The worksheet has been the regular classroom and ESE teachers' traditional method for remediating arithmetic disabilities. The traditional worksheets used emphasized the appropriate arithmetic content for each subject. In the traditional worksheet activity the subjects were instructed to work alone, avoid interaction with others, do their best work and seek help and clarification from the teacher. Subjects were instructed to work at their own pace, doing as much of the assigned material as possible in the time allowed. Subjects were separated to minimize distractions. The response sheets were scored individually and the teacher praised each subject individually on the basis of one's own work.

Each subject received intervention on their instructional level in each respective arithmetic operation, regardless of his or her group placement. The duration of the study was approximately 13-17 periods of instruction over a three week period. During the study, observations were made of the subjects on-task behavior while working in the three learning activities. At the end of the study, subjects were given a posttest, form B of the Computational Skills Survey. The hypotheses were tested.

Observation of On-Task Behavior

The two dependent variables included in the study were (a) scores on the arithmetic posttest and (b) time on-task, which was observed and measured by using the following procedure. The observers used for data collection of subjects' on-task behavior in the three types of learning activities were six doctoral students in the Department of Special Education of the College of Education. Prior to data collection, the observers were trained to be behavioral observers by the researcher during a pre-experimental training period. The researcher used a 25 minute videotape of a middle school arithmetic lesson in the classroom setting to train observers. The observers acquired the following skills: (a) accurate observation of time on-task (see definition in Chapter I) and (b) facility with the recording form (see Appendix E) and a watch, while viewing the videotape. Neither the observers nor the subjects were informed of the actual purpose of the study in order to prevent an observer bias. During the pre-experimental period, paired observers were assigned the same student to observe on videotape. After the observers had recorded the assigned students' on-task behavior (see form, Appendix E), interrater agreement was ascertained between the paired observers. An interrater agreement of .80 was required of all paired observers for three consecutive times before data collection began.

The duration of the study consisted of approximately 13-17 periods of instruction with the assigned activities over a three-week period. The observers observed the subjects on three different occasions, at random, during the study period. The six observers observed no more than three subjects per session. The subjects were observed in their ESE arithmetic classes, during the 25-minute instructional time alloted for working on the three types of learning activities. The observers synchronized their watches and looked up at the subjects they were observing every 30 seconds. If the subjects were on-task the observers recorded a "+" and for off-task observers recorded a "-". This allowed for 50 observations per subject, each time the subject was observed.

Arithmetic Posttest

Subjects were administered an arithmetic posttest, form B of the Computational Skills Survey, to determine the differences between groups. The test was administered to subjects individually on two different days (last two days of the study). The highest score of the two was used.

Design and Data Analysis

The purpose of this study was to determine the effect of cooperative and competitive games on arithmetic performance and on-task behavior. The independent variable was the type of learning activity, with three levels: (1) cooperative games, (2) competitive games, and (3) traditional worksheets. The dependent variables were test scores on the arithmetic posttest (Computational Skills Survey) and time on-task. The relationship between performance on arithmetic and time on-task for learning disabled adolescents in the three types of learning activities was examined. The three group posttest design, with an arithmetic pretest as covariate, was analyzed through a one-way analysis of covariance (ANCOVA). The researcher used the Bonferroni procedure for post hoc tests to determine which pairs of groups were different. Alpha was set at .05. On the arithmetic performance measure the number of subjects was used as the unit of analysis in the cooperative games, competitive games, and traditional worksheets condition. In other words, each individual's score on the posttest was used to compute means for each condition. Time on-task observations were analyzed through ANCOVA and the Johnson-Neyman technique. The correlation between arithmetic scores and on-task behavior were analyzed using the Pearson product-moment. An error analysis was conducted on each student's pretest in order to pinpoint the specific type of errors present in his or her arithmetic performance. This information helped the researcher and trained teacher to focus on the error patterns that needed to be remediated for each student daily (see Table 2). For example, the following error might have been evidenced in multiplication:

$$\begin{array}{r} 25 \\ \times\ 8 \\ \hline 160 \end{array}$$

This answer was incorrect because the student did not add the regrouped number to the answer of the second multiplicand. The specific error pattern was that the regrouped number was not added. The purpose of the error analysis in this study was to analyze the type of errors made by students included in the study, and to use this analysis to pinpoint which specific error patterns to remediate in the identified operational area for each student.

Table 2

Specific Error Patterns

1. Response:

$$\begin{array}{r} \overset{1}{6}8 \\ +\ 8 \\ \hline 156 \end{array} \qquad\qquad \begin{array}{r} \overset{1}{7}3 \\ +\ 9 \\ \hline 172 \end{array}$$

Error Pattern: When the tens column is added, the single-digit number is added to the numeral in the tens column (the lower addend is added twice).

2. Response:

$$\begin{array}{r} \overset{5}{\cancel{6}}{}^{1}3{}^{1}2 \\ -147 \\ \hline 495 \end{array} \qquad\qquad \begin{array}{r} \overset{4}{\cancel{5}}{}^{1}2{}^{1}3 \\ -366 \\ \hline 167 \end{array}$$

Error Pattern: When regrouping is required more than once, the appropriate amount is not subtracted from the column borrowed from in the second regrouping.

3. Response:

$$\begin{array}{r} 36 \\ \times\ 9 \\ \hline 274 \end{array} \qquad\qquad \begin{array}{r} 43 \\ \times\ 6 \\ \hline 248 \end{array}$$

Error Pattern: The regrouped number is not added.

4. Response:

$$\begin{array}{r} 21 \\ 6\overline{)1206} \\ \underline{1200} \\ 6 \\ \underline{6} \end{array}$$

Error Pattern: The zero in the quotient is omitted.

(Adapted from Mercer & Mercer, 1981)

CHAPTER IV

RESULTS

Thirty-six sixth through eighth grade learning disabled adolescents enrolled in exceptional student education (ESE) math classes in two public middle schools participated in this study. The purpose of this study was to investigate the effectiveness of cooperative and competitive games with learning disabled adolescents on arithmetic performance and on-task behavior. The relationship between arithmetic performance and time on-task for learning disabled adolescents in three types of learning activities was examined.

Data were analyzed using an analysis of covariance (ANCOVA) to control statistically any initial differences in the subjects which might have confounded differences among the three groups of subjects. Descriptive data of the three groups are provided in Appendix G. The chapter is divided into sections which correspond with the null hypotheses.

Arithmetic Performance

Null hypothesis number one states that there are no differences in arithmetic posttest scores for learning disabled adolescents who participate in cooperative games, competitive games, and traditional worksheet learning activities. The analysis of covariance (ANCOVA) was used to answer this question, after testing the first assumption that the within group regression slopes are equal across the treatment levels. The covariate taken into consideration was the arithmetic pretest. The interaction term (i.e., pretest with group) was found non-significant, therefore, it was assumed that the slopes were parallel. The adjusted and unadjusted means and standard deviations for each group area are presented in Table 3, all groups were composed of 12 students; the analysis of covariance summary table is presented in Table 4. The F value was significant at the .05 level, which means the treatments are not equally effective in remediating arithmetic disabilities. The significant difference among the groups was followed up with post hoc tests. The Bonferroni procedure was used, controlling for error rate per family, which is setting the groups of comparisons at one level of significance ($p \leq .05$). Keppel (1982) and Kirk (1968) state that it is generally not recommended by statisticians that a researcher utilize per comparison contrast procedures (i.e., Least Squares Difference (LSD), but rather a per family procedure (i.e., Bonferroni). The Bonferroni yielded a significant difference in the means of the cooperative games group and the traditional worksheet group. The subjects who received traditional worksheets demonstrated higher arithmetic performance ($\overline{X}$ = 43.52) than those who participated in cooperative games ($\overline{X}$ = 37.08). There was no significant difference in the means of those

Table 3

Means and Standard Deviations for Arithmetic Performance

Type of Learning Activity	Pretest $\overline{X}$	Posttest $\overline{X}$	Standard Deviations (Posttest)
Cooperative Games	33.75	37.08 (adjusted) 41.42 (unadjusted)	8.74 3.45
Competitive Games	24.42	42.64 (adjusted) 38.75 (unadjusted)	8.56 8.11
Traditional Worksheets	28.33	43.52 (adjusted) 43.08 (unadjusted)	7.72 7.18
Total Group	28.83	41.08	

Table 4

ANCOVA Summary Table

Source	DF	Sum of Squares	F
Pretest	1	788.833	39.86*
Group	2	220.608	5.57*
Error	32	633.25	

*$p \leq .05$

subjects who participated in the cooperative games group ($\overline{X}$ = 37.08) and those who participated in the competitive games group ($\overline{X}$ = 42.64) at .05. Hovever, the probability that the difference occurred by chance between the cooperative and competitive group was .0549, favoring the competitive games group. And, there was no significant difference in the means of those who participated in the competitive games group ($\overline{X}$ =42.64) and those who received the traditional worksheets ($\overline{X}$ = 43.52). The highest possible score for the pretest and the posttest was 50.

On-Task Behavior

Null hypothesis number two states that there are no differences in the amount of time on-task among learning disabled adolescents who participate in cooperative games, competitive games, and traditional worksheet learning activities. Data on on-task behavior was collected during the treatment phase. To answer this question, the researcher used the ANCOVA procedure, with arithmetic pretest as the covariate. The first assumption that the within group regression slopes of on-task behavior for the three groups on the pretest are equal was tested and found significant. Because the relationship between on-task behavior and the pretest was not the same for each group, ANCOVA could not adjust the on-task behavior percentages for the three groups based on their pretest scores. The number of subjects, means, and standard deviations for on-task behavior by groups are presented in Table 5. Also, an analysis of covariance summary table is presented in Table 6. The presence of such a significant interaction ($F(2,30) = 5.57$, $p \leq .05$) precluded interpretation of the test of overall treatment effect, but it also indicated that there were differential treatment effects in relation to scores on the pretest. The overall group interaction is presented in Figure 2.

Results indicate that subjects with low pretest scores who participated in cooperative games show a higher percentage of on-task behavior than subjects who had higher pretest scores. It is important to note that part of the line drawn (see Figure 2) for the cooperative group was extrapolated because there were no pretest scores below 29 for this group. Thus, all subsequent interpretations of low ability students in the cooperative group were based on that extrapolation. It appears to be no difference in predicted percentage of on-task behavior for subjects who participated in competitive games, whether their pretest scores were low or high. For the traditional worksheet group, it appears that when their pretest scores were low their on-task behavior was low. And, as their pretest scores increased their on-task behavior increased.

Table 5

Means and Standard Deviations for On-Task Behavior

Type of Learning Activity	N	$\overline{X}$	Standard Deviation
Cooperative Games	12	.7250	0.11
Competitive Games	12	.9092	0.04
Traditional Worksheets	12	.9433	0.07

Table 6

ANCOVA Summary Table

Source	DF	Sum of Squares	F
Pretest	1	0.013	2.45
Group	2	0.031	3.07
Interaction	2	0.057	5.57*
Error	30	0.153	

*p ≤ .05

The Johnson-Neyman technique was employed to establish regions of significance for the interaction (Kerlinger & Pedhazur, 1973). This technique indicates how high (and how low) pretest scores should be in order for treatment group means to be significantly different on on-task behavior. When comparing the cooperative games group with the competitive games group (see Figure 3), the results indicate that students with pretest scores lower than 19.91 (which is in the extrapolated region) in the cooperative group were more on-task than students with lower scores in the competitive games group. Students with pretest scores higher than 29.45 in the cooperative group were significantly less on-task than students with higher scores in the competitive games group. The null hypothesis was rejected for this comparison.

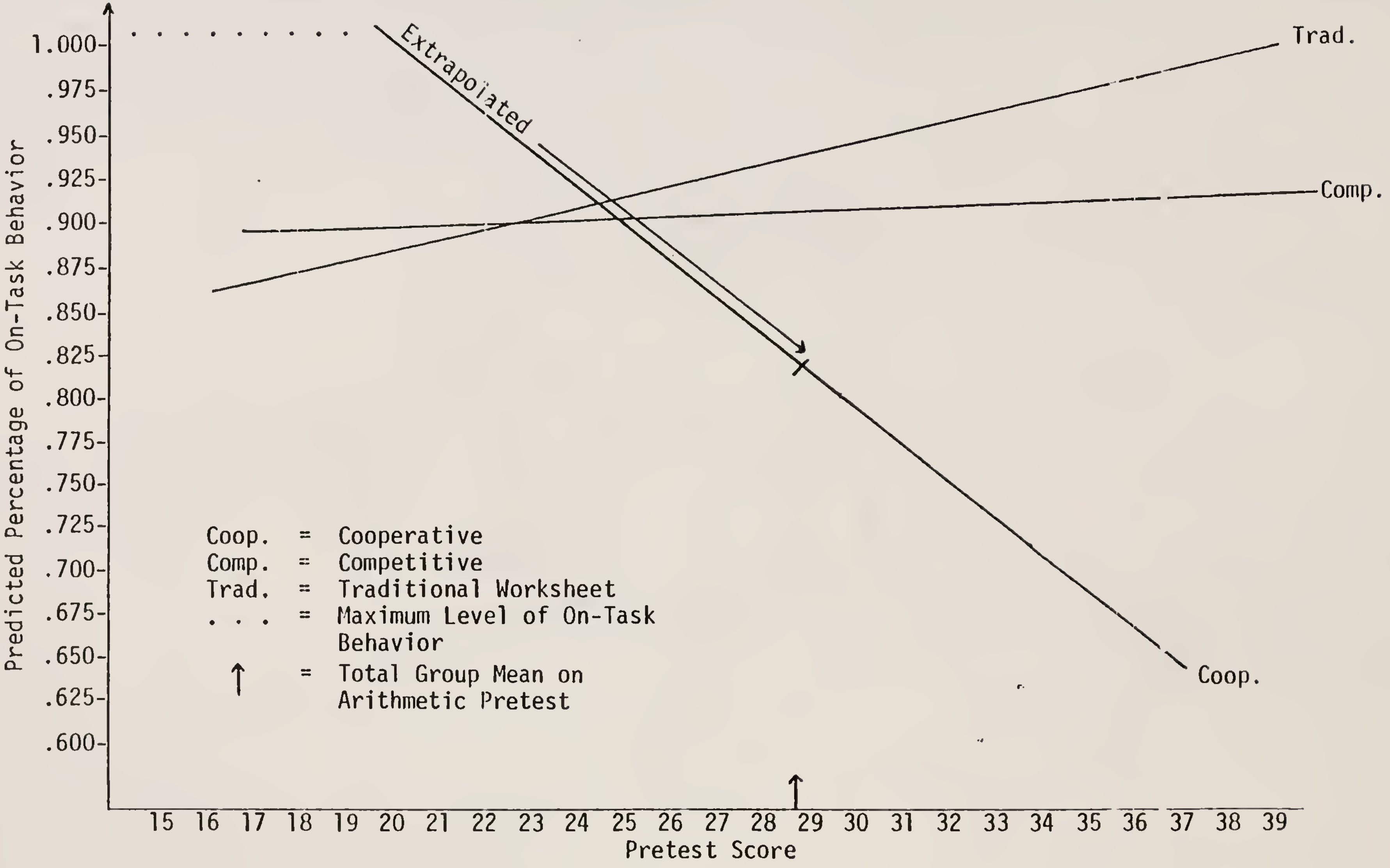

Figure 2

Treatment Group by Pretest Interaction for Overall Group

The results for the comparison of the cooperative games group with the traditional worksheet group (see Figure 4), indicate that students with pretest scores lower than 21.32 (which is in the extrapolated region) in the cooperative games group were more on-task than students with lower scores in the traditional worksheet group; also, students with pretest scores higher than 28.06 in the cooperative games group were significantly less on-task than students with higher scores in the traditional worksheet group. The null hypothesis was rejected for this comparison.

When comparing the competitive games group with the traditional worksheet group (see Figure 5), there was no difference at any point of ability on the pretest shown in the Figure. It was concluded there were no significant differences between the competitive games group and the traditional worksheet group. The null hypothesis was accepted for this comparison.

Means and standard deviations for the arithmetic pretest are presented in Table 7. Results indicate that when ability is much lower than the sample average on the arithmetic pretest of 28.83, the cooperative games group did significantly better than the competitive games group (Pretest score ≤ 19.91) on on-task behavior and significantly better than the traditional worksheet group (Pretest score ≤ 21.32). For students with ability levels close to or higher than the average of 28.83, the competitive games group was significantly more on-task than the cooperative games group (Pretest score ≥ 29.45). And, the traditional worksheet group

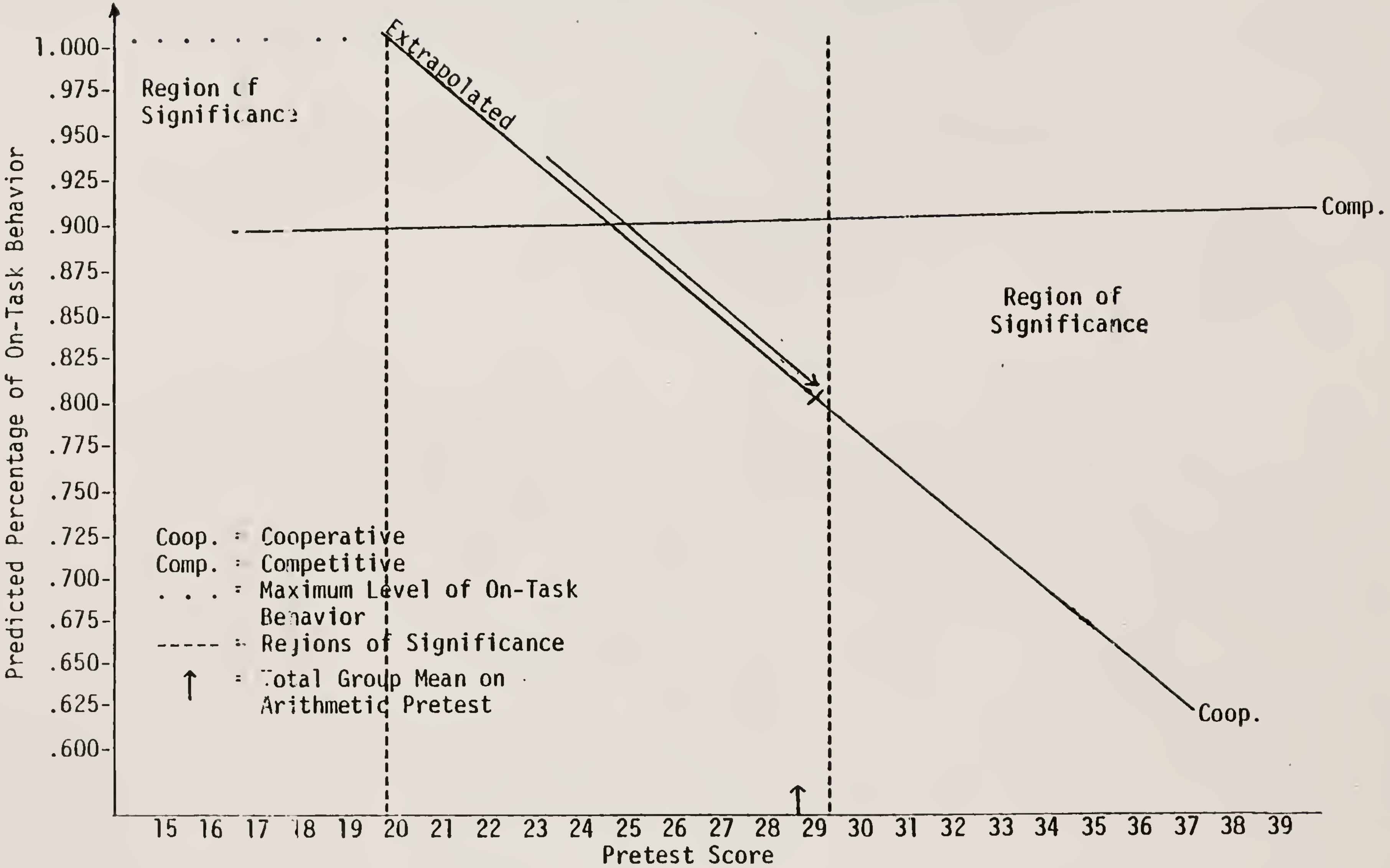

Figure 3

Treatment Group by Pretest Interaction for Cooperative Versus Competitive Games Group

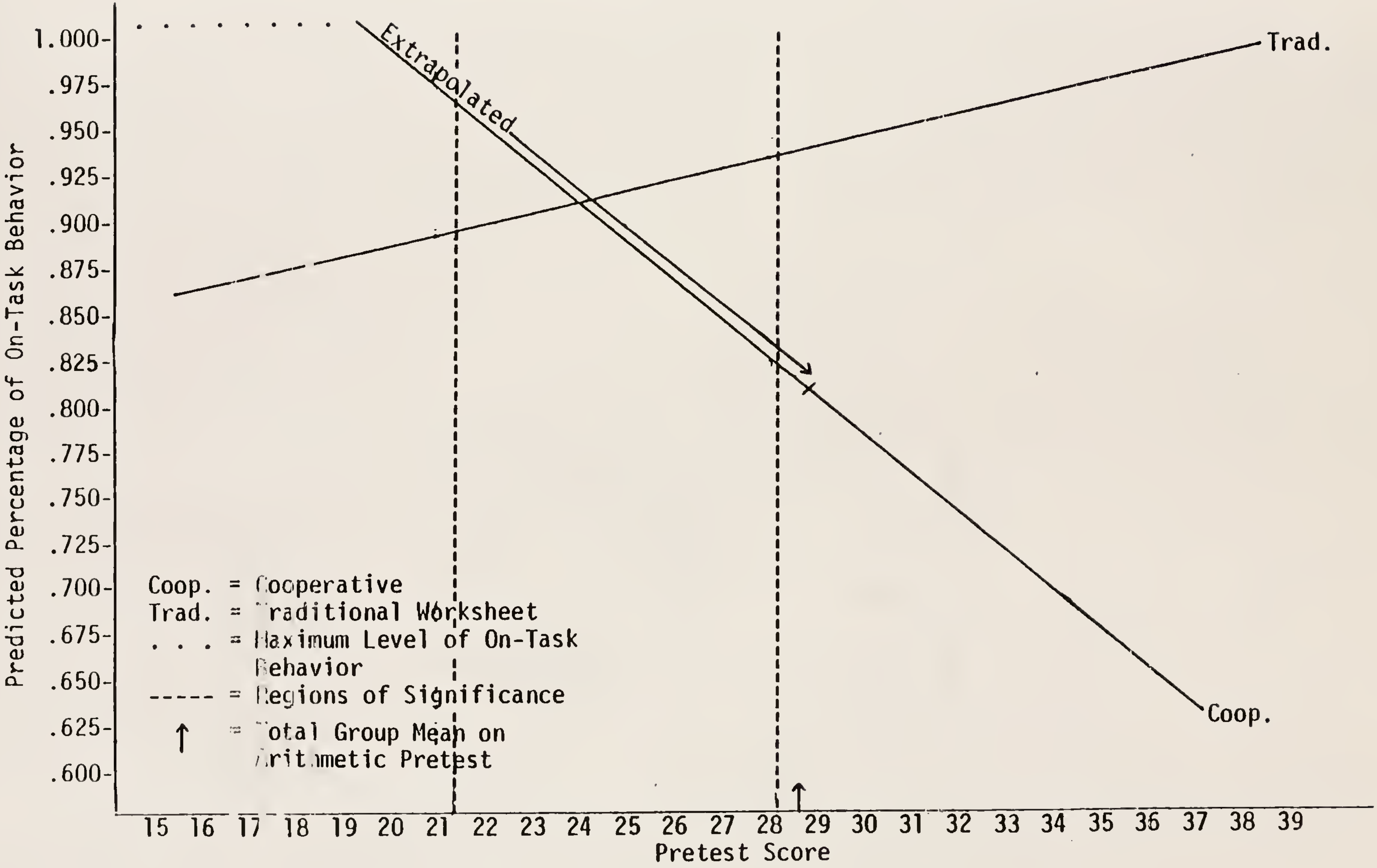

Figure 4

Treatment Group by Pretest Interaction for Cooperative Versus Traditional Worksheet Group was significantly more on-task than the cooperative games group (Pretest score ≥ 28.06). There was no significant difference on on-task behavior between the competitive games group and the traditional worksheet group at any of the observed arithmetic pretest scores.

Table 7

Means and Standard Deviations for Arithmetic Pretest

Type of Learning Activity	$\bar{X}$	Standard Deviations
Cooperative Games	33.75	2.86
Competitive Games	24.42	6.10
Traditional Worksheets	28.33	6.85
Total Group	28.83	6.64

Arithmetic Performance and On-Task Behavior

Null hypothesis number three states that there is no relationship between arithmetic performance and time on-task for learning disabled adolescents who participate in cooperative games, competitive games, and traditional worksheet learning activities. Correlations between arithmetic performance and on-task behavior by groups are presented in Table 8.

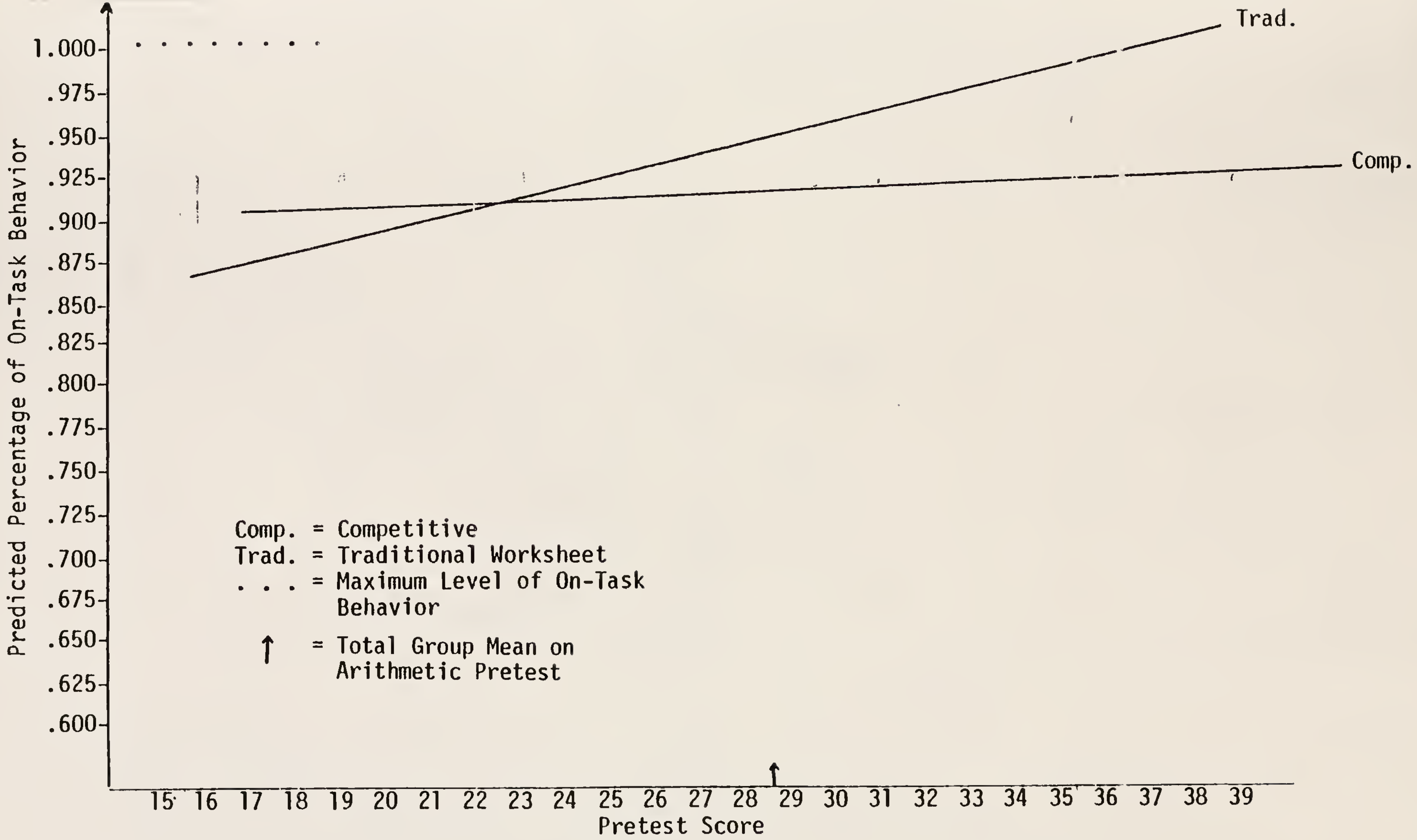

Figure 5

Treatment Group by Pretest Interaction for Competitive Versus Traditional Worksheet Group

Note: No regions are shown since the lower bound limit is 9.75 and the upper bound limit is 57.44. Both of these sets of points are outside the observed score.

The relationship between arithmetic performance and on-task behavior for all subjects was low ($r = .12$, $p \leq .05$), accounting for only one percent of observed variance in arithmetic performance on the posttest. The null hypothesis for the overall group was accepted. There was no significant relationship between arithmetic performance and on-task behavior. The correlation observed for subjects who participated in cooperative games was negative and lower than that for the total group ($r = -.07$, $p \leq .05$), accounting for only .005 percent of the observed variance. The null hypothesis was rejected. There was no relationship between arithmetic performance and on-task behavior for learning disabled adolescents who participated in competitive games ($r = .09$, $p \leq .05$). The correlation observed for subjects who received traditional worksheets was high ($r = .68$, $p \leq .05$) which accounts for .46 percent of the observed variance. Thus, there was a high correlation between arithmetic performance and on-task behavior for subjects who received traditional worksheets. The null hypothesis was rejected for the traditional worksheet group.

Results indicate that the relationship between arithmetic performance (posttest) and on-task behavior was signigicant only for the traditional worksheet group. There was no relationship between these two variables for either the cooperative games group or the competitive games group.

Table 8

Correlations Between Arithmetic Performance and On-Task Behavior

Type of Learning Activity	N	r
Cooperative Games	12	r = -.07
Competitive Games	12	r = .09
Traditional Worksheets	12	r = .68*
Overall Group	36	r = .12

*$p \leq .05$

Specific Error Patterns Analysis

A specific error pattern analysis was conducted on subjects' pretests and posttests. The typical error patterns present in the subjects' arithmetic performance are presented in Table 9. Results indicate that 28 percent of the students subtracted the smaller number from the larger number without regard for placement of the number. When regrouping was required more than once, 17 percent of the students did not subtract the appropriate amount from the column borrowed in the 2nd and/or 3rd regrouping when zeros were involved. More than one arithmetic operation was performed on a given problem by 25 percent of the students. When there were two or more multipliers in a problem, 11 percent of the students inappropriately alternated multiplying by those numbers. And, 11 percent of the students multiplied by columns.

Table 9

TYPICAL ERROR PATTERNS DISPLAYED IN THE STUDY

Response:

$$\begin{array}{r} 627 \\ -\ 486 \\ \hline 261 \end{array} \qquad \begin{array}{r} 761 \\ -\ 489 \\ \hline 328 \end{array}$$

Error Pattern: The smaller number is subtracted from the larger number without regard for placement of the number. The upper number (minuend) may be subtracted from the lower number (subtrahend).

Response:

$$\begin{array}{r} 4007 \\ -\ 2679 \\ \hline 1{,}438 \end{array}$$

Error Pattern: When regrouping is required more than once, the appropriate amount is not subtracted from the column borrowed in the 2nd and/or 3rd regrouping when zeros are involved.

Response:

$$\begin{array}{r} \overset{1}{3}56 \\ +281 \\ \hline 62\underline{5} \end{array} \qquad \begin{array}{r} 5\overset{5}{\cancel{6}}4 \\ -427 \\ \hline \underline{9}37 \end{array} \qquad \begin{array}{r} 12 \\ \times\ 4 \\ \hline 158 \end{array} \qquad \begin{array}{r} 362 \\ -243 \\ \hline 605 \end{array}$$

Error Pattern: Cross operations are performed across arithmetic areas.

Response:

$$\begin{array}{r} \overset{2}{3}\overset{2}{7}5 \\ \times\ 45 \\ \hline 1505 \end{array} \qquad \begin{array}{r} 523 \\ \times\ 20 \\ \hline 1040 \end{array}$$

Error Pattern: Cross multiplies.

Response:

$$\begin{array}{r} \overset{2}{3}\overset{2}{5}8 \\ \times 342 \\ \hline 1116 \end{array} \qquad \begin{array}{r} 247 \\ \times 553 \\ \hline 1221 \end{array}$$

Error Pattern: Multiplies by columns.

Summary

An analysis of covariance (ANCOVA) and the Bonferroni post hoc procedure was used to test the following null hypothesis:

1. There was no difference in the arithmetic scores among learning disabled adolescents who participated in cooperative games, competitive games, and traditional worksheet learning activities. The null hypothesis was rejected. A significant statistical difference existed between the cooperative games group and the traditional worksheet group, favoring the traditional worksheet group at .05 level of significance. While no significant statistical results were indicated between the cooperative games group and the competitive games group, there seems to be a predicted direction for differences in favor of the competitive games group. No significant statistical difference existed between the competitive games group and the traditional worksheet group.

An analysis of covariance (ANCOVA) and the Johnson-Neyman technique was used to test the following null hypothesis:

2. There was no difference in the amount of time on-task among learning disabled adolescents who participated in cooperative games, competitive games, and traditional worksheets. The on-task comparisons between the groups must be cautiously interpreted because much of the data had to be extrapolated using the Johnson-Neyman technique. Results indicate a significant statistical difference in the amount of time spent on-task between the cooperative and competitive games

group. The difference favored the cooperative games group for lower ability students, and competitive games for higher ability students. The null hypothesis was rejected for this comparison. There was a significant statistical difference in the amount of time spent on-task between the cooperative games group and the traditional worksheet group. The difference favored the cooperative games group for lower ability students and the traditional worksheet group for higher ability students. The null hypothesis was rejected for this comparison. Further, results indicate that there was no significant statistical difference in the amount of time spent on-task between the competitive games group and the traditional worksheet group. The null hypothesis was accepted for this comparison.

The Pearson product-moment correlation analysis was used to test the following null hypothesis:

3. There was no relationship between arithmetic performance and time on-task for learning disabled adolescents who participated in cooperative games, competitive games, and traditional worksheets. There was no significant statistical relationship between arithmetic performance and on-task behavior for the overall group. The null hypothesis for the overall group was accepted. There was a significant statistical relationship between arithmetic performance and on-task behavior for the traditional worksheet group. The null hypothesis was rejected for the traditional worksheet group.

CHAPTER V

LIMITATIONS, IMPLICATIONS, AND CONCLUSIONS

This chapter discusses the findings of this investigation. Specifically, the findings are discussed in terms of limitations, implications, and conclusions.

Learning disabled (LD) adolescents frequently manifest an academic disability in arithmetic skills. They often hide behind shallow rote ability in arithmetical computation, which is needed to ensure competencies for their consumer needs and everyday living experiences (Bartel, 1978). The secondary level teacher often utilizes teaching methods and materials that are not appropriate and are not sensitive to the individual needs of these students (Beattie, 1981; Wallace & McLoughlin, 1979). And, there are comparatively fewer research and intervention efforts for remediating arithmetic deficits, than exists for other academic areas (i.e., science, music, etc.) (Bartel, 1978).

A sensitive and individualized teaching technique is essential for remediating arithmetic deficits of learning disabled adolescents. One possible strategy available in teaching LD adolescents is the use of games (Beattie, 1981; Mercer, 1979). A close examination of the literature reveals little information on the use of instructional games as a technique to remediate arithmetic deficits of learning disabled adolescents. The present study focused on the possible arithmetic performance and on-task behavior differences between learning disabled adolescents using cooperative games, competitive games, and the traditional worksheet learning activities. In addition, the study was concerned with the possible relationship between arithmetic performance and on-task behavior. Twelve subjects were assigned to the cooperative games group, 12 to the competitive games group, and 12 to the traditional worksheet group. An arithmetic posttest was administered to determine differences in the arithmetic performance of cooperative game, competitive game, and traditional worksheet groups. Additional information was obtained by quantifying actual on-task behaviors displayed by LD subjects in each of the three learning activities. Correlational studies were conducted to determine the potential relationship between arithmetic performance and on-task behavior.

Limitations

Several possible limitations exist. Exceptional student education (ESE) teachers were not willing to be trained to implement the study as planned, because each of them taught students of varying exceptionalities each period (i.e., emotionally handicapped, LD) and varying academic subjects. Conducting the treatments in this situation, according to ESE teachers, would have caused classroom management problems. They were very cooperative in permitting the researcher and a teacher trained by the researcher to come into their classrooms and work with the groups. Moreover, they helped the researcher obtain a separate space outside their classrooms when necessary. There was a limited number (not more than six) of eligible subjects attending ESE mathematics classes per period, thereby, limiting the amount of random assignment that could have existed. Also, the limited number of subjects per period resulted in the researcher's changing the procedures for the competitive games group as outlined by Johnson and Johnson studies (i.e., rotating 1st, 2nd, and 3rd place winners in each cluster the following day; see Appendix F). As a result of the assignment procedure, with so few students per period and grouping students with similar math ability, the means for the groups on the screening device (pretest) were significantly different from the beginning of the study. Consequently, this caused the researcher to change the plans for data analysis from an analysis of variance (ANOVA) to analysis of covariance (ANCOVA). Analysis of covariance satistically controls for any initial differences in the students which might have been present and which might have confounded differences between the treatments. Subjects' tardiness and absenteeism could not be controlled. In all four cooperative groups, there seemed to be a little "goofing off," lack of sharing and tutoring skills. The researcher and trained teacher facilitated their behavior to get students back on-task. This should be taken into consideration when interpreting results for the cooperative games group. Also, all interpretations of on-task behavior for low ability students in the cooperative games group should be read with much caution due to an extrapolated line drawn for scores lower than those observed for the group. Each student was accustomed to remediation via the traditional worksheet technique. This usual response mode precluded distractions and problem solving errors that might have affected other response ways that were newer to the students. Given these limitations, the results of this study have several important implications for both theory and practice.

Implications

Arithmetic Performance

The finding that subjects in the traditional worksheet group demonstrated higher arithmetic performance than those who participated in the cooperative games group is noteworthy. The discussion of the findings concerning arithmetic performance is presented in terms of (a) goal structures and cognitive outcomes, (b) the type of tasks, and (c) cautious interpretations of arithmetic performance results.

Goal structures and cognitive outcomes. Previous research findings have been inconsistent as to whether a cooperative, competitive, or individualistic (in this case, the traditional worksheet-control group) goal structure is most conducive to achievement. Johnson and Johnson (1975) point out some specific cognitive outcomes teachers should promote and try to influence through instruction, which includes (a) mastery of basic facts, concepts, principles, and skills, (b) cooperative problem-solving skills needed to develop and revise knowledge, which is also essential for the retention, application, and transfer of factual information, concepts, and principles, (c) creativity through interaction among individuals, which involves engaging in divergent thinking and open controversy, and taking risks in solving problems, (d) students' identifying their abilities and applying them in problem-solving situations, (e) quantity and speed of work on simple drill activities, and (f) students' ability to take the perspective of other individuals within a situation, which is an important prerequisite for the development of social adaptability, communication ability and skills, empathy and sympathy, and free moral judgment based upon mutual dependence and justice.

Table 10 presents Johnson and Johnson's (1975) summary of the relationship between goal structures and cognitive outcomes of instruction. The Johnsons. point out that research indicates the type of cognitive outcomes facilitated by cooperative goal structures are the more complex ones (e.g., problem-solving ability). The type of cognitive outcomes facilitated by competitive goal structures are speed and quantity on simple drill activities which requires little assistance from other persons. And, the type of cognitive instructional objectives facilitated by individualistic goal structures are simple tasks (e.g., organizing a material).

Johnson and Johnson's summary in Table 10 suggests that this study promoted problem-solving ability. Although problem-solving ability is shown as a cognitive outcome facilitated by the cooperative goal structure, this study found problem-solving ability to be best facilitated by the competitive and individualistic (traditional worksheet) goal structures. Some possible reasons why the individualistic goal structure (traditional worksheet) was more effective than the cooperative goal structure follow. First, incorporation of the tra-

Table 10

Goal Structures and Cognitive Outcomes

Cognitive Outcomes	Cooperative	Competitive	Individualistic
Mastery of factual information			x
Retention, application, and transfer of factual information, concepts, principles	x		
Mastery of concepts and principles	x		
Verbal abilities	x		
Problem-solving ability and success	x		
Cooperative skills	x		
Creative ability: divergent and risk-taking thinking, productive controversy	x		
Awareness and utilization of one's capabilities	x		
Perspective- (role-) taking abilities	x		
Speed and quantity of work on simple drill activities		x	
Competitive skills		x	
Individualistic skills			x
Simple mechanical skills			x

Source: Johnson, D. W., & Johnson, R. *Learning together and alone: Cooperative, competitive, and individualization.* Englewood Cliffs, NJ: Prentice-Hall, 1975, p. 32.

ditional worksheet into the arithmetic curriculum permitted the student to move through the material at his own pace and level of ability. On the contrary, cooperative games involved one student directing or influencing another's pace. Although students in the cooperative games group were grouped on similar levels of math ability, students in this condition solved problems at varying paces which may have caused students to receive tutorial instruction from their peers either too quickly or too slowly to grasp a clear understanding of the process involved.

Another reason individualistic was better than cooperative is that the worksheet allowed students to work alone without distractions. To the contrary, the cooperative games allowed for much interaction and interruptions from peers.

Third, students' work habits may have been influenced by who was perceived to be the major resource for assistance, support, and reinforcement in each goal structure. In the individualistic goal structure (traditional worksheet), the teacher was the major resource for students, and in the cooperative goal structure (games) other students were perceived to be the major resource for support. The assumption that students will work on their own with little or no assistance from the teacher should not be made. In reality, many LD students need help, approval, and interaction from the teacher regardless of how independent the materials are believed to be (Johnson & Johnson, 1975).

Another possible reason the individualistic goal structure (traditional worksheet) was better than the cooperative goal structure may be related to Lue's (1981) finding that specific learning disabled students are in 1:1 instructional situations for a good portion of their instructional time. This suggests that because the traditional worksheet group was accustomed to this form of instruction, it may have influenced their performance.

Finally, students who received traditional worksheets appeared to receive more practice on the arithmetic task than subjects who participated in cooperative games. While the cooperative and worksheet groups received work on their individual levels, students with worksheets did not have to alternate working problems with peers, thereby decreasing the amount of problems that could be solved per session. The cooperative group alternated tutoring and checking each other's problems.

The data from this study indicate that arithmetic performance of students in the competitive games group was not significantly different from those who received traditional worksheets. This finding suggests that the classroom teacher has a choice of remediating arithmetic deficits of LD adolescents via competitive games or traditional worksheets. Johnson and Johnson (1975) pointed out that the competitive goal structure provides appropriate practice for some of the skills learned in an individualistic or cooperative setting, and a "game" format is often used (i.e., tasks include reading, language games, math facts and calculation speed).

No statistical significance was found between the means of the cooperative and competitive game groups. There appears, however, to be a "predicted direction" (Hallahan, Kauffman & Ball, 1973) for competitive games (.0549 level of signficance, favoring competitive) to be a better learning activity for remediating arithmetic deficits of LD adolescents than cooperative games. In other words, if this study was replicated, there is a possibility that with longer treatment and a larger sample size, the competitive group might score significantly better than the cooperative group. This prediction is supported by the fact that a few students in the cooperative games group would not consistently share their ideas and the materials assigned. Also, students' lack of concern for tutoring another student in the cooperative games group was sometimes displayed. Further, if a student was goofing off in a cooperative games group, other students became annoyed sometimes and refused to play. In each of these situations, the teacher facilitated the students' behavior; however, other students should have been perceived as the major resource of assistance, support, and reinforcement (Johnson & Johnson, 1975).

Another reason for the prediction that the competitive games group may be better than the cooperative games group is that students participating in cooperative games were not able to complete as many arithmetic problems as students participating in competitive games. Thus, students playing competitive games spent more time solving arithmetic problems than students in the cooperative games group. The primary reason for students not completing as much work in the cooperative games group was because of the amount of time it took students to tutor each other.

The teacher may not need to teach competitive skills prior to using competitive games in the classroom,once the competition has been set up appropriately (outlined in Chapter I). Students in the competitive games group can (a) work alone on their individual levels, (b) compare ability, skills, and knowledge with peers, (c) perceive the teacher as the primary resource for help, clarification, and praise, (d) enjoy the activity (win or lose), and (e) be rewarded individually (Johnson & Johnson, 1975).

Type of task. There is some concern that a situational factor, such as the type of task as a predictor of the outcomes of various comparisons between the different goal structures, has been given too little attention by the Johnsons (Cotton & Cook, 1982). Also, another concern is that Johnson, Maruyama, Johnson, Nelson, and Skon's (1982) major result that cooperation is superior to other goal structures in promoting achievement indicates that most investigators have selected types of tasks that favor cooperation (McGlynn, 1982). A review of studies on the relative effects of cooperative, competitive, and individualistic goal structures on achievement on a variety of school related tasks are presented in Table 11 (see other details about these studies in Chapter II). The most striking finding was the consistent superiority of cooperation on problem-solving tasks.

The Johnsons' studies reviewed indicate that a problem-solving task is a more complex task than either speed and quantity on simple drill activities which requires little assistance from other persons, or simple tasks like organizing a material. Generally, students have not been exposed to the material used in problem-solving tasks, or the difficulty level of the content increases to help the student revise and develop his knowledge and skills, and the task usually is solved with the help of a teacher or other students in the group. According to the Johnsons' description of a problem-solving task, this study

Table 11

Review of the Effects of The Three Goal Structures on Achievement on a Variety of School Related Tasks

Author(s)	Subjects	Tasks	Relative Effectiveness
Johnson, Johnson, & Skon (1979)	middle-class 1st graders	1. Two drill-review tasks	
		(a) math drill-review task Consisted of 60 written, one digit add. & sub. problems. All Ss had been taught add. & sub. processes several months before.	Coop. > Comp. & Indiv.
		(b) reading drill-review task Involved two worksheets using skills just completed by the lowest reading gps. represented in sample. 1st pg. required Ss to choose words to complete nine phrases. 2nd pg. required Ss to complete six sentences to match them to pictures.	Coop. > Comp. & Indiv.
		2. Two problem-solving tasks	
		(a) Ss were given copies of 10 story problems that were read orally by the teacher. Involved one digit add. & sub.; some of the problems involved two computations.	Coop. > Comp.
		(b) Ss were given four sequencing problems, each of which had four parts to be numbered in the order that would tell a logical story. Ss were given parts in random order.	Coop. > Comp. & Indiv.

Coop. = Cooperative
Comp. = Competitive
Indiv. = Individualistic

Table 11--Continued

Author(s)	Subjects	Tasks	Relative Effectiveness
		3. Two spatial-reasoning tasks (a) a version of the Rasmussen Triangle A diagram containing an ambiguous no. of triangles. Ss were given three pgs., each containing nine copies of the diagram. Ss were instructed to color all of the possible triangles without repetition. Included the learning of the concept "triangle," the reorientation of visual perception to include small, previously identified triangles within a larger new triangle (combining of parts), the discrimination of triangles from nontriangles within the diagram, and the keeping track of triangles previously identified so that the same triangle was not counted more than once.	Coop. & Indiv. >Comp.
		(b) a visual sorting task Involving observation and comparison of the attributes of shape, size, and color. Ss asked to do several problems related to categorizing, such as examining a reservoir of figures on a pg. and making the figure that is the same as the one given or marking the two figures that are the same. Six problems dealt with a single attribute (shape, size, or pattern), six problems dealt with the attributes in paired combinations, and two problems dealt with all three attributes.	Coop. >Comp. & Indiv.

Table 11--Continued

Author(s)	Subjects	Tasks	Relative Effectiveness
Johnson, Johnson, & Tauer (1979)	middle and lower middle-class non-graded 4th, 5th, & 6th grade sections	1. Focused on the learning of geometry, a mathematics unit not previously studied by any of the students. The geometry unit dealt with finding the area of regions from simple designs through more complex forms to advanced structures. The same material was given to all three conditions each day.	Coop. > Comp. > Indiv.
Johnson, Skon, & Johnson (1980)	middle and working class 1st graders	1. Ss required to memorize 12 nouns during a study session.	
		(a) Free recall performance	Coop. > Comp; Coop. > Indiv.
		(b) Spontaneous retrieval performance	Coop. > Comp; Coop. > Indiv.
		(c) Categorization of strategy	Coop. > Comp; Coop. > Indiv.
		(d) Awareness of strategy	Coop. > Comp; Coop. > Indiv.
		2. A spatial-reasoning problem (same as Johnson, Johnson & Skon (1979). Two measures included:	
		(a) Number correct (performance)	Coop. > Indiv; Coop. > Indiv.
		(b) Errors (performance)	Coop. > Comp.; Coop. > Indiv.
		3. Verbal problem-solving task consisting of 10 math story problems (same as Johnson, Johnson, & Skon, 1979).	
		(a) Verbal reasoning	Coop. > Comp; Coop. > Indiv.

Table 11--Continued

Author(s)	Subjects	Tasks	Relative Effectiveness
Johnson, Johnson, Johnson, & Anderson (1976)	White working class 5th graders	1. Understanding and using sentences Purpose of material was to teach the two basic parts of the sentence, the concept of the verb as the word in the predicate, the four types of sentences, and to give Ss practice in writing good sentences. The material was divided into parts, each part consisting of one or more new concepts, explanatory material, and exercises to develop the concepts. First, a section from the material (book) was read orally by the students in the whole class of 30. A discussion of the material followed involving all 30 students. When the teacher felt that the students understood the new material well enough to do the assignment, assignment sheets were passed out and stud/ time followed. Six measures included:	
		(a) Number of daily errors	Coop. >Indiv.
		(b) Number of errors on posttest, individuals vs. group	Coop. >Indiv.
		(c) Number of errors on posttest, taken as individuals	Coop. =Indiv.
		(d) Number of words used in subject phrases	Coop. >Indiv.
		(e) Number of words used in predicate phrases	Coop. >Indiv.
		(f) Percentage of original subject phrases beginning with "I"	Coop. >Indiv.

Table 11--Continued

Author(s)	Subjects	Tasks	Relative Effectiveness
Johnson, Johnson, & Scott (1978)	middle-class, above average 5th & 6th graders	1. Problem-solving task (a) Two units studied were on advanced set theory and advanced number theory. (b) Third unit was an individualized program based on geometry and measurement in Eicholz and O'Daffer. All materials were structured for use in an indiv. math program. All assignments required thinking skills and not just computational skills. The students had never been exposed to any of the materials before in school The difficulty level of the content increased from set theory to number theory to geometry Three measures of achievement were:	
		1. Number of errors made on each daily assignment	Coop. > Indiv.
		2. Posttests on each of the three math units (a) unit on sets, numbers, and geometry Posttest taken as individuals	Indiv. > Coop.
		Posttest taken in their groups in coop. group vs. indiv. in the indiv. group	Coop. > Indiv.
		(b) unit on number-theory programs Posttest taken as individuals	Coop. > Indiv.
		Posttest taken in their groups in coop. group vs. indiv. in the indiv. group	Coop. > Indiv.

Table 11--Continued

Author(s)	Subjects	Tasks	Relative Effectiveness
		(c) unit on geometry problems	
		Posttest taken as individuals	Coop. > Indiv.
		Posttest taken in their groups in the coop. grp. vs. indiv. in the indiv. grp.	Coop. > Indiv.
		3. Retention test (administered two months after study ended)	
		Retention test taken as individuals	Indiv. > Coop.
		Retention test taken in their groups in the coop. grp. vs. indiv. in the indiv. grp.	Coop. > Indiv.
Johnson, Johnson, (1979)	middle-class & lower middle-class 5th graders N=66 (equal % of males and females)	*Duration: Three 60 minute instructional sessions 1. Drill-review task A math review using 26 two-place multiplication problems All Ss had learned two-place multiplication several months previous to the study and had been consistently drilled. Two measures included:	
		(a) Errors [performance]	Coop. > Comp. & Indiv.
		(b) Number correct [performance]	Indiv. & Coop.> Comp.

* This study was not included in Chapter II

Table 11--Continued

Author(s)	Subjects	Tasks	Relative Effectiveness
		2. Problem-solving task A version of the Rasmussen Triangle, a diagram containing an ambiguous number of triangles. Same task as in Johnson, Johnson, & Skon (1979). Three measures included:	
		(a) Errors [performance]	Coop. > Comp. > Indiv.
		(b) Number correct [performance]	Coop. > Comp. > Indiv.
		(c) Quality of solutions	Coop. > Comp. > Indiv.
		3. Specific-knowledge-acquisition task Programmed-learning booklet materials focused on dividing words into prefix and root, introducing the root or prefix to be learned, and then requiring the S to interpret a word using the root or prefix. All the words in the materials were new to the Ss. The assigned material covered about 15 pages, five pages per session, with approximately seven questions on each page. Two measures included:	
		(a) Errors [performance]	Coop. > Comp. & Indiv.
		(b) Number correct [performance]	Coop. & Comp. > Indiv.

Table 11--Continued

Author(s)	Subjects	Tasks	Relative Effectiveness
		4. Specific-knowledge-retention task A test on the roots and prefixes covered in the specific-knowledge-acquisition task. It was given immediately after Ss had stopped work on the programmed materials at the end of the period. Two measures included: (a) Errors [performance] (b) Number correct [performance]	Coop.=Comp.=Indiv. (when no. of Coop. grps. used as n in Coop. condition); Coop. > Comp. & Indiv. (when no. of Ss used as n in Coop. condition)

implemented such a task. Initially, learning disabled (LD) students were given a computational skills pretest to determine which basic computational skills (i.e., addition, subtraction, multiplication, and division) the students had mastered well and which skills should be taught. To be included in the study, students must have scored less than 80 percent on an arithmetic pretest. Although some students had knowledge of two of the four operational areas of arithmetic, others had some knowledge of all four operational areas. But, each arithmetic operation had six levels of difficulty and none of the students in the study had observable knowledge and skills across the four operational areas of arithmetic and the six levels of difficulty. This suggests that the task used in this study did meet criteria for a problem-solving task.

In analyzing a variety of tasks (Johnsons' studies, Table 11), the cooperative goal structure was consistently better than the competitive and individualistic goal structures on

(a) 75 percent of all measures on drill-review tasks.

(b) 100 percent of all measures on problem-solving tasks that included the three goal structures.

(c) 50 percent of all measures on spatial-reasoning tasks.

(d) 50 percent of all measures on a specific-knowledge-acquisition task.

(e) 100 percent of all measures on a memorization task.

(f) 100 percent of all measures on a retention task (when the number of students was used as n in the cooperative condition).

Also, the cooperative goal structure was better than the individualistic goal structure on

(a) 85 percent of all measures on problem-solving tasks that included only cooperative and individualistic goal structures.

(b) 50 percent of all measures on a retention task (when the cooperative group took the posttest in their own groups and the individualistic group took the posttest as individuals).

Thus, Table 11 shows that although the superiority of cooperation is substantial for complex tasks (problem-solving), it tends to be as good or better than competition and the individualistic goal structures on simple drill activities and organizing a material (respectively).

Further analysis of a variety of tasks indicates that the results of this study corroborate the findings of previous research. Specifically, students in the individualistic goal structure performed better on one out of two problem-solving tasks in one study (Johnson, Johnson, & Scott, 1978) where posttests were taken as individuals instead of groups in the cooperative and individualistic conditions. In another study (Johnson, Johnson, & Anderson, 1976), however, individualistic and cooperative were equally effective on students' achievement. Also in Johnson, Johnson, and Scott (1978), students in the individualistic goal structure retained more then students in the cooperative goal structure on a retention task when the posttest was taken as individuals in both groups. Thus, this study and some previous research indicate that when students in the cooperative and individualistic groups are posttested individually on a problem-solving task, students in the individualistic condition have performed better than those in the cooperative condition. On the other hand, when students in the cooperative condition are posttested in their own groups and students in the individualistic group are tested as individuals, the cooperative group has performed significantly better than the individualistic group.

Cautious interpretations of the arithmetic performance results. The researcher used analysis of covariance (ANCOVA) to test the null hypothesis that there are no differences in arithmetic posttest scores for learning disabled adolescents who participate in the cooperative games, competitive games, and traditional worksheet learning activities. Analysis of covariance (ANCOVA) is suppose to statistically control for any initial differences in the students which might have been present and which might have confounded differences between the treatments. But, some researchers believe ANCOVA does not adjust for initial differences between populations successfully or with total satisfaction. Thus, cautious interpretations of the arithmetic performance results should be considered.

Table 3 (Chapter IV) presented the adjusted and unadjusted means and standard deviations for arithmetic performance for each group. A cautious interpretation of the arithmetic performance results can be considered when looking at the unadjusted posttest means and pretest means. The raw data indicate that the competitive games group (14 point increase) and the traditional worksheet group (15 point increase) generated more rapid learning than the cooperative games group (8 point increase). In light of these increases in performance, one may argue that it is more difficult to increase the performance of students who began an intervention with higher scores than it is to increase the performance of students who began the intervention with lower scores.

On-Task Behavior

The presence of a significant interaction between the covariate (pretest) and the dependent variable (on-task behavior) prevented the interpretation of the test of overall treatment effect, but it also indicated that there were differential treatment effects for subjects at certain levels of the pretest. The Johnson-Neyman technique, a follow-up analysis, was used to indicate how high (and how low) pretest scores should be in order for treatment group means of on-task behavior to be significantly different. The fact that the cooperative group had no pretest scores lower than 29 resulted in the researcher's extrapolating part of the line of predictability for scores that were 28 or lower. Thus, all subsequent interpretations of low ability students in the cooperative group were based on this extrapolation and should be read with much caution.

The significant differences between the amount of time on-task among the groups depend on the level of pretest ability. In examining the contrast between the cooperative games group versus the competitive games group it was found that when the level of ability was lower for the cooperative games group they were more on-task than the lower ability students in the competitive games group.

When the level of ability was higher for the cooperative games group their on-task behavior was significantly lower than that of subjects with higher ability in the competitive games group. In examining the contrast between the cooperative games group versus the traditional worksheet group it was found that when the level of ability was lower for the cooperative games group they were more on-task than the lower ability students in the traditional worksheet group. And, when the level of ability was higher for the cooperative games group, their on-task behavior was significantly lower than that of students with higher ability in the traditional worksheet group. For the contrast between the competitive games group and the traditional worksheet group, there was no difference at any point of ability on the pretest. The two regions of significance for these groups were outside any of the observed pretest scores (as low as 9.75 and as high as 57.44), with the highest possible pretest score being 50. Therefore, it was concluded that for the observation of this study there were no significant differences between the competitive games group and the traditional worksheet group.

Achievement and On-Task Behavior

The results indicate a low relationship between arithmetic performance and time spent on-task for the overall group ($r = .12$, $p \leq .05$). The analysis of data indicate that the subjects receiving the traditional worksheets were generally on-task to a higher degree ($r = .68$, $p \leq .05$) and in addition scored higher on the arithmetic posttest performance. Nevertheless, there was only a small relationship between arithmetic performance and on-task behavior. Beattie (1981) pointed out in his study that subjects may fulfill the definition of on-task behavior, but may only give the appearance of paying attention. This might have been the situation with students participating in cooperative games. Students in the cooperative games group had a wider range of on-task behavior than students in the competitive games and worksheet groups. For example, when it was subject A's turn to roll the die and solve an arithmetic problem from his or her task cards, subject B and C were suppose to be paying attention to what subject A was doing. Subject B and C's on-task behavior could have included

(a) observing subject A solve the problem
(b) helping or tutoring subject A.
(c) observing the gameboard.
(d) talking with each other about the game.

Although some of the students in the cooperative games group were looking at the relevant, assigned task stimulus and their pencils were to paper, sometimes they did not complete the assigned material. While their eye gazes may have been directed toward the task, this did not mean they were learning math or that they were paying attention.

Students in the competitive games group had a tighter range of on-task behavior than students in the cooperative games group. Students playing competitive games were on task when

(a) they played their games individually, and sought help from the teacher when needed.

(b) they occasionally glanced their competitors' gameboard to assess their progress in the game.

Students in the worksheet group had the most restrictive range of on-task behavior. Students in this group were on task when they solved problems on the worksheets independently and sought help from the teacher when needed. Students in the worksheet group seemed to be more involved in solving arithmetic problems at all times ($r = .68$, $p \leq .05$). They appeared to be goal-oriented and would complete their assigned problems and continually ask the teacher for additional problems until the allotted work time was over. The findings of this study indicate that the relationship of arithmetic performance and on-task is a function of treatment (see Chapter I for definitions of on-task behavior, and Chapter III for observers' procedures used).

Some learning disabled students may lack cooperative skills. Johnson and Johnson (1975) indicated that "... cooperative skills are essential to a person's self-actualization, i.e., the development of one's potentialities and the utilization of those potentialities" (p. 32). Some of the learning disabled adolescents in this study may have lacked cooperative skills. Some observations of the behaviors displayed by students in the cooperative games group follow. A few of the male students in the study sang rhythm-and-blues songs throughout the instructional sessions, and/or pretended to be playing a guitar while singing in the group. These students had no regard for other students in the group who were trying to concentrate on solving their math problems.

On occasion, some of the students in the cooperative games group would roll the die more than one time, move several spaces on the gameboard, and solve several of their arithmetic problems at once. This was not suppose to be done, and when the students that did this were spoken to they would argue that the game was being played too slowly. When these students were told that each person was suppose to take one turn at a time, sometimes they would sit and sulk with the group. Also, sometimes the child would miss several turns until others in the group pleaded with him to play the game.

There were times when a few children in the cooperative group would talk out to other students in the classroom while the game was going on. This type of behavior was quite disruptive for the group.

Finally, a few students would give their full attention to the group when it was their turn to play, and when it became a team member's turn to play their attention was elsewhere; or, the student that was not paying much attention to the game would tell the other students that their answers were correct without really checking over the answers.

Relationship of Present Findings to Previous Research

The present findings and previous research on cooperative, competitive, and individualistic goal structures were not corroborated. Several factors may have contributed to the differences in the findings. One reason for differences in the findings may be due to the fact that this study was conducted with 36 learning disabled adolescents from middle-class to below middle-class background, in grade six through eight. Previous research (Johnson, Johnson, & Skon, 1979; Johnson, Johnson, & Tauer, 1979; Johnson, Skon, & Johnson, 1980; Johnson, Johnson, Johnson, & Anderson, 1976; and Johnson, Johnson, & Scott, 1978) was conducted with larger samples of (more and less than 36) students from regular education populations. The students were from middle-class and lower middle-class backgrounds, in grades one through six.

Another reason for differences in the findings may be that this study was conducted in 13 instructional sessions with 45 minute periods per day (approximately nine hours and 45 minutes of instruction). Much of previous research of this type has been conducted in six instructional sessions with 40-60 minute periods per day (approximately six hours of instruction). Thus, this study involved approximately three hours and 45 minutes more instructional time than previous studies.

Further, this study included a disproportionate number of boys and girls. Previous studies have included an equal number of boys and girls (approximately).

A fourth reason for the differences may be due to the fact that this study modified Johnson and Johnson's procedures for the competitive games group because of the small sample size, which made it impractical to rotate 1st, 2nd, and 3rd place winners in each of the competitive groups daily. Because of the small sample size of this study, the competitive games group operated with slightly rigid procedures than the procedures outlined by Johnson and Johnson. A more operational definition of the competitive goal structure needs to be developed.

Fifth, all of the subjects in the present study were accustomed to the individualistic goal structure (traditional worksheets). In previous studies, subjects were taught the skills of the goal structure that was to be studied. Thus, cooperative groups were taught cooperative skills in previous studies, and the cooperative games group was not taught cooperative skills prior to this study.

Another factor that may contribute to differences in the findings is the type of materials used to present a problem-solving task. The present study used games and worksheets. Previous studies have used story problems, individualized programmed math materials, and other materials.

Finally, students in the cooperative games group took the arithmetic posttest as individuals, whereas some of the previous researchers have reported posttest score performances for the cooperative group as individuals and/or their having taken the posttest in their own groups. Each of these differences should be taken into consideration when interpreting the findings of this study and previous research.

Suggestions for Future Research

The present study indicates that teachers may select from a variety of learning activities in their classrooms, such as cooperative, competitive, and individualistic learning activities. There are variations in the amount of time spent on-task in various learning activities. Differences among groups exist for learning disabled adolescents in the activities. Traditional worksheets seem to work better overall for arithmetic performance, and for on-task behavior, the activity that is better depends on the level of ability. Following are suggestions for future research.

1. Replication of this study needs to be conducted in the ESE classroom setting with ESE teachers providing implementation.

2. The generalization of results is limited by the specific arithmetic materials used, the nature of the students participating in the study, and the size of sample. Future studies need to include students from different populations (i.e., emotionally handicapped, educable mentally handicapped, regular education students), different curriculum materials, and larger samples of students (so that randomization is not limited).

3. Replication of this study should include low ability students in the cooperative games group.

4. Caution should be used to ensure more or less equal groups from the beginning of the study.

5. Replications need to be undertaken at other grade levels as well as other locations in order to improve generalizability of results.

6. Replication using a different type of task is needed.

7. Teacher education programs may wish to engage in research to increase their emphasis on the use of three types of learning activities in the classroom situation.

8. More research is needed to help determine why learning

disabled adolescents in the cooperative group with high ability scores appear to manifest more off-task behavior than students with high scores in the other groups.

9. Techniques need to be developed to prevent disruptive behavior of learning disabled adolescents in the cooperative group.

10. A more unified effort at operationalizing the definition of on-task behavior is needed to ensure a more acceptable way to measure on-task behavior.

11. Task difficulty needs to be studied in terms of cooperative and competitive games.

Summary

As a result of this study, it is apparent that the traditional worksheet is more successful in remediating arithmetic disabilities of learning disabled adolescents than cooperative games. The fact that there was no statistical difference between the competitive games and the traditional worksheet groups suggests that the classroom teacher has a choice of remediating arithmetic deficits of LD adolescents via competitive games or traditional worksheets. Also, there seems to be a predicted direction for competitive games to be better than cooperative games.

There was a significant difference in the amount of time on-task between the cooperative games group and the competitive games group, favoring the competitive games group for high ability students, but favoring the cooperative games group for low ability students. Also, there was a significant difference in the amount of time spent on-task between the cooperative games group and the traditional worksheet group, favoring the traditional worksheet group for high ability students, but favoring the cooperative games group for low ability students.

There was no significant relationship between arithmetic performance and on-task behavior for the overall group. For the traditional worksheet group there was a significant relationship between on-task behavior and arithmetic performance.

APPENDIX A

SPECIFIC VERBAL INSTRUCTIONS GIVEN TO STUDENTS UNDER THE THREE TYPES OF LEARNING ACTIVITIES

I. Cooperative Games Group

On the first day of the study, students were introduced to the group they were going to work with throughout the study. Their seats were prearranged in an area of the classroom before they came to class (seated together at a small table). When students arrived in the classroom, they were to sit in their assigned seats and listen to the following instructions.

a. Task

"This is an arithmetic game. Your group will be given a gameboard and a response sheet. Each person has been assigned their own set of arithmetic 'task cards,' which are cards with arithmetic problems on them. You should use these cards each time it is your turn to play. You have 25 minutes to work. In the last 15 minutes, I will collect and score your response sheet."

b. Learning conditions

(1) "You are to work together as a group, completing one daily response sheet as a group.

(2) All members must share materials and ideas.

(3) Make sure all members are involved and understand how to derive each answer.

(4) Seek help and clarification from fellow group members rather than the teacher. Do not talk with others in the classroom.

(5) Each person in the group will be asked to sign the response sheet where it says, "Student's Name," which tells me you understand how to solve each problem listed under your name.

(6) Each day I will put the names of each person in your group in a box, then I will pull one name and ask that person to explain how to solve one problem from his row of problems. This will be done so that I can determine whether each person understands how to solve the problems in his area and whether the group is following my instructions."

c. Scoring

"Each member of the group will receive a group score. So, there is no need to compete with other groups or to compete with others in your group. You will be praised and rewarded on the basis of what your group achieves. The total number of arithmetic problems wrong on the response sheet will serve as your group score."

d. Playing the Cooperative Game

(1) To begin: "Open the gameboard and place it on one of your desks. Place your arithmetic task cards nearest you on the gameboard. Place the response sheet on one of your desks also. Roll the die for first play. The player rolling one or nearest one will play first, the next person rolling nearest two will play second, and the last player will play third. Write your names on the response sheet where it says, 'Student's Name,' in the order you will take turns. Place the colored pawn on 'Start' and begin."

(2) To play: "The first player rolls and moves the number spaces indicated, then draws one of his arithmetic task cards. Write the problem down on the response sheet under your name area.

A player completes his turn by working his arithmetic problem alone, then writing the answer on the response sheet. The other members of the group must tell whether they agree with the answer, in order for the answer to remain on the sheet. If the other players agree with the answer, then the second player takes his turn. If the players do not agree with his answer, they must explain how he should solve the problem. The player should make certain he or she understands how to solve the problem before writing the correct answer.

The second player, and then each in turn, rolls the die, moves that number of spaces, draws a task card, writes the problem down, and tries to solve it alone. Continue to follow the procedure as you did for player number one.

Please do not compete with other groups in the classroom by rushing to complete the game. And, do not compete with others in your group."

(3) To end: "The game ends when all task cards have been drawn and each problem has been solved; or when the group reaches 'Home' or 'Finished,' or when I say the 25 minutes for playing the game is over."

II. Competitive Games Group

On the first day of the study, students were introduced to the group they were going to work with throughout the study. Their seats were prearranged in an area of the classroom before they came to class (seated separately, but near the others in their group). When students arrived in the classroom, they were to sit in their assigned seats and listen to the following instructions.

a. Task

"This is an arithmetic game. Each person will be given a gameboard and a response sheet. Each person has been assigned his own set of arithmetic 'task cards,' which are cards with arithmetic problems on them. You should use these cards each time you spin. You have 25 minutes to work. In the last 15 minutes, I will collect and score your response sheet."

b. Learning Conditions

(1) "You are to work alone.

(2) Attempt to win in your group.

(3) Seek help and clarification from the teacher when you need to. Do not talk with others in the group or classroom.

(4) You are seated near each other in the group so you can be aware of your competitors' progress. Notice when they raise their hands to signal completion of a task.

(5) As you raise your hands, I will collect the response sheets and number them in the order received (1st, 2nd, or 3rd)."

c. Scoring

"The response sheets will be scored individually to determine 1st, 2nd, and 3rd place winners within the group. The winner will be determined by who finishes first with the greatest amount of accuracy. You will be praised and rewarded on the basis of the individual performance of each person in the group."

d. Playing the Competitive Game

(1) To begin: "Open the gameboard and place it on your desk. Place your arithmetic task cards nearest you on the gameboard. Place the response sheet near your gameboard also, and write your name on it."

(2) To play: "Spin the spinner, move that number of spaces on your gameboard, draw one of your arithmetic task cards, write the problem down on your response sheet, solve the problem, check it, and roll again.

Complete each turn by working the problem alone and writing the answer on your response sheet. If you need help, please ask me.

Notice your competitors' gameboards occasionally to see where they are in terms of completing the gameboard. And notice when they raise their hands to signal completion of the game. Remember, each of you is trying to win. I will collect the response sheets in the order students raise their hands."

(3) To end: "The game ends when all task cards have been drawn and each problem has been solved; or when you reach 'Home' or 'Finished,' or when I say the 25 minutes for playing the game is over."

III. Traditional Worksheets Group

On the first day of the study, students' seats were prearranged in an area of the classroom before they came to class (seated separately to minimize distractions). When students arrived in the classroom they were to sit in their assigned seats and listen to the following instructions.

a. Task

"This is an arithmetic worksheet. Each person will be given their own set of worksheets. Please work the arithmetic problems on these sheets. You have 25 minutes to work. In the last 15 minutes, I will collect and score your worksheets."

b. Learning Conditions

(1) "You are to work alone and avoid talking with others.

(2) Do your best work.

(3) Seek help and clarification from me when you need to.

(4) Work at your own pace.

(5) Do as much of the assigned material as possible."

c. Scoring

"The worksheets will be scored individually and you will be praised individually on the basis of your own work."

d. Working with Worksheets

(1) To begin: "Take your worksheets out of the yellow envelope with your name on it. Work the arithmetic problems that have a dot over them. Work each of the problems alone. If you need help, please ask me."

(2) To end: "The worksheet activity ends when each worksheet has been completed; or when I say the 25 minutes for working arithmetic problems is over."

APPENDIX B

ALACHUA COUNTY PROCEDURES

Specific Learning Disabilities

Specific learning disabilities--one who exhibits a disorder in one (1) or more of the basic psychological processes involved in understanding or in using spoken and written language. These may be manifested in disorders of listening, thinking, reading, talking, writing, spelling, or arithmetic. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to an environmental deprivation.

1. Criteria for Eligibility

    a. Evidence of a disorder in one (1) or more of the basic psychological processes.

    (1) Based on a student's expected level of functioning, a score of two (2) standard deviations or less below the mean in one (1) process area or a score of one and one-half (1.5) standard deviations or less below the mean in three (3) or more process areas. Process areas are defined as: visual channel processes, auditory channel processes, haptic channel processes, language processes, and sensory integrated processes. In cases where the standard deviation is not available, a score of 70% or less of the student's expectancy age in one (1) process area of 80% or less in three (3) or more process areas may be used.

    (2) Only tests or subtests appropriate for the student's chronological age shall be used for placement purposes.

    Illinois Test of Psycholinguistic Abilities (ITPA)

    Visual Closure (VC)
    Visual Sequential Memory (VSM)

Visual Association (VA)
Auditory Closure (AC)
Auditory Memory (AM)
Auditory Association (AA)

Detroit Tests of Learning Aptitude (DTLA)

Pictorial Absurdities (1)
Pictorial Opposites (3)
Verbal Opposites (4)
Auditory Attention Span for Unrelated Words (6)
Visual Attention Span for Objects (9)
Designs (12)
Auditory Attention Span for Related Syllables (13)
Visual Attention Span for Letters (16)
Disarranged Pictures (17)
Oral Directions (18)
Likenesses and Differences (19)

Bender Motor Gestalt Test (Bender)

(3) If more than one process test or subtest is given in any process cluster area, the mean level of functioning will be used to establish a deficit. Process clusters and the tests or subtests used to measure them appropriately for the student's chronological age are:

Clusters	Battery (CA 2 to 10)	Battery (CA 10.1+)
Visual Perception	ITPA-VC,DTLA-3	
Visual Memory	ITPA-VSM,DTLA-9	DTLA-9,16
Visual Association	ITPA-VA, DTLA-1	DTLA-17
Auditory Perception	ITPA-AC	
Auditory Memory	ITPA-AM, DTLA-6,13	DTLA-6,13
Auditory Association	ITPA-AA,DTLA-4	DTLA-4,19
Visual Motor	Bender,DTLA-12	DTLA-12
Auditory Motor	DTLA-18	DTLA-18

(4) Evidence of a process strength at or above the student's expected level of functioning.

b. Evidence of academic deficits.

(1) Based on the student's expected level of functioning, a score of: 85% expectancy age or below for third (3) through sixth (6) grade; 75% expectancy age or below for seventh (7) through ninth (9) grade; or, 65% expectancy age below tenth (10) through twelfth (12) grade is required in one (1) or more of the following academic areas:

reading, writing, arithmetic, or spelling. For students in kindergarten (kg) through second (2) grade, evidence must be presented that achievement is 85% expectancy age or below on preacademic tasks which require listening, thinking, or speaking skills. A student may not be placed for a deficit in either writing or spelling or both.

(2) If more than one academic instrument is used to document a weakness, the results must consistently show deficits in the same academic area. If more than one level of functioning is obtained, the mean level of functioning will be used to establish weakness.

c. Evidence that learning problems are not due primarily to other handicapping conditions.

(1) A score at or above one standard deviation below the mean on an individual test of intellectual functioning or evidence that a score below one standard deviation is not a reliable indicator of the student's intellectual potential.

If the full scale on a Wechsler test is not within one standard deviation from the mean, the student must have one score (verbal or performance) that is within one standard deviation from the mean. If a valid Wechsler score is not available for any individual case, the Directors of Exceptional Student Education and Student Services must agree on comparable criteria that indicate the student's intellectual potential.

(2) For students with visual processing deficits, visual acuity above 20/70 in the better eye with best possible correction, or evidence that the student's inability to perform adequately on tasks which require visual processing is not due to poor visual acuity.

(3) For students with auditory processing or language deficits, auditory acuity loss of less than 30 decibels in the better ear unaided, or evidence that the student's inability to perform adequately on tasks which require auditory processing or language is not due to poor auditory acuity.

(4) For students with a motor handicap, evidence that their inability to perform adequately on tasks which assess the basic psychological process is not due to the motor handicap.

(5) For students who exhibit persistent and consistent severe emotional handicaps, evidence that their inability to perform adequately on tasks which assess the basic psychological processes is not due to the emotional handicap.

d. Documented evidence which indicates that viable general educational alternatives have been attempted and found to be ineffective in meeting the student's educational needs.

2. Procedures for Screening

a. School personnel, parents or appropriate community agencies may assist in the screening process to identify students who may have problems or special needs.

b. Information is gathered from school, home and community resources to help in making the student's needs more specific. The screening process may include:

(1) Observation of school behavior and/or observation and performance records from community agencies.

(2) Information and comments from student's cumulative record.

(3) Survey or standardized and non-standardized testing results from schools or community agencies.

(4) Screening of students by support personnel in areas such as language, motor and social development.

3. Procedures for Referral

See section on General Procedures

4. Procedures for Student Evaluation

In addition to the requirements outlined in the General Procedures section, the following procedures for student evaluation are required:

a. Prior to referral for determining eligibility, the following data shall be collected at the student's school:

(1) Evidence of the student's sensory functioning.

(2) Any social, psychological or medical data included in the student's cumulative folder.

(3) Student attendance record if excessive absences are noted, and the reasons for the excessive absenteeism.

(4) Documented and dated evidence that conferences concerning the student's specific problem have been conducted. These conferences shall include, but not be limited to, the parents or guardian, administrative personnel and teaching personnel.

(5) Documented evidence of at least two (2) educational alternatives attempted within the school. The documented evidence must be written, dated and signed by the person implementing the educational alternatives.

(6) Behavioral observations in the classroom which indicate the student's learning problem that the interventions were designed to remediate. At least two (2) observations are required. One may be done by the classroom teacher, and at least one must be conducted by an evaluation team member other than the child's regular teacher. For placement consideration, these must be made after completion of the interventions.

Reevaluation includes (a) revision of individual educational program periodically, but not less than annually, and (b) that a minimum of a formal (achievement) evaluation of the child is conducted at least every three years, or whenever conditions warrant, including at the request of the student's parents or teachers.

5. Procedures for Determining Eligibility and Educational Placement

In addition to the general requirements for determining eligibility and educational placement, these requirements must be met in the areas of specific learning disabilities.

A multi-disciplinary team will meet to determine whether or not the student exhibits the characteristics of a specific learning disabled student. The team must be composed of at least: a regular classroom teacher, an SLD teacher or specialist with knowledge in the area of specific learning disabilities, a psychologist or other person qualified to administer an individual diagnostic examination of children, such as school psychologist, speech/language pathologist, or remedial reading teacher.

a. The evaluation/staffing committee shall prepare a written report containing the results of the staffing. The report must include a statement of:

(1) Whether the student has a specific learning disability.

(2) The basis for making the determination.

(3) The relevant behavior noted during the observation of a child.

(4) The relationship of that behavior to the student's academic functioning.

(5) The educationally relevant medical findings, if any.

(6) Whether there is a severe discrepancy between achievement and ability which is not correctable without special education and related services.

(7) The determination of the team concerning the effects of environmental, cultural, or economic disadvantage.

Each team member shall certify in writing whether the report reflects his or her conclusion. If it does not reflect his or her conclusion, the team member must submit a separate statement presenting his or her conclusions. Each member may submit a separate report with a cover page containing a conclusion statement and dated and signed by each member of the evaluation team. The conclusion statement may be that the team feels that the student is or is not specific learning disabled and why. If any member disagrees, the team member must submit a separate statement presenting his or her conclusions. It may be possible for the student to be eligible but not require special education services. A continuum of alternative placements is described in the section on Special Program Organization.

6. Procedures for Providing an Educational Plan

See section on General Purposes.

7. Procedures for Dismissal or Reassignment

Placements are reviewed annually, based on the student's individual plan.

a. Steps in the review process may include:

(1) The ESE teacher reviews effectiveness of the educational plan of the student at intervals throughout the year and at the end of the year.

(2) A conference with other school personnel, ESE teacher, and/or parents.

(3) Additional evaluation by student services personnel with follow-up conference.

b. Dismissal may be recommended by an in-school staffing when these standards are met:

(1) Attainment of these levels in academic performance on individually administered standardized achievement tests.

90% of expectancy age for grades Kg-6
85% of expectancy age for grade 7 and up

-4 months for this computed level may be used for consideration for dismissal.

Standardized tests to measure achievement may include: Key Math, WRAT, PIAT, Woodcock-Johnson. All academic areas should be measured.

A student should meet dismissal criteria in all academic areas; however, students should not remain in the specific learning disabilities class for a spelling deficit alone unless recommended by the staffing committee. Support services for spelling (consultation, program planning, etc.) can be arranged upon request of the regular education teacher.

(2) Supporting data must be present. Supporting data may include, but is not limited to:

(a) Regular and special education teachers' input (criteria reference tests, standardized tests, MAT, work samples, grades).

(b) Statewide Assessment Tests.

(c) Behavioral observations in the regular classroom.

(3) Process deficits do not need to show evidence of remediation on a standardized process test for a student to be considered for dismissal.

(4) Students from grades 8-12, who refuse to attend class, a staffing should be held with student, parents, classroom teachers, specific learning disabilities teacher, principal, or designee. Alternatives should be discussed for student attendance on a regular basis, then the parent should be notified that he has the option of dropping his child from the program.

(5) The major emphasis of the specific learning disabilities program should be in the deficit areas characteristic of each student. As these areas are remediated, a gradual phase out into regular education classroom should occur. At the time of dismissal staffing, special education time in program should be at a minimum level. Full-time trial placement in the regular education program may be used for a limited length of time. Dismissal may be considered in an eligibility staffing when it is evident that a less restrictive educational setting is available and appropriate for the student.

8. Special Program Organization

The least restrictive appropriate educational setting is provided for the student. The program is structured in such a way to allow a specific learning disabled student to receive instruction in a:

a. Basic class with supplementary consultation or special education services.

b. Basic class supplemented by itinerant instruction or a resource room program.

c. Special class, either full-time or part-time, in a regular school.

d. Varying exceptionalities classroom utilized for the resource room and/or special class.

e. Hospital or home setting.

9. Instructional Program

The program for specific learning disability students has the following goals:

a. To assess the student's level of functioning in the psychological process areas and in the academic areas of reading, writing, arithmetic, and spelling.

b. To provide prescriptive instruction at the operational level for each student in his problem area or areas.

c. To provide a program that will aid the student in adjusting to the school and group environment and to function appropriately in a regular classroom.

d. To provide consultative services to instructional personnel by providing suggestions for appropriate levels in instruction, materials, and methods.

Curriculum for the elementary school student with specific learning disabilities is individualized and focuses on remediating the student's process and academic deficits. The Alachua County Basic Skills Continuum and the Alachua County Elementary Program Objectives for Language Arts and Math will be utilized to ensure that the general sequence of curriculum is presented consistently with the rest of the school's program.

At the secondary level, the primary objective will be to utilize the student's strengths in the acquisition of knowledge. Programs should also begin to include vocational curriculum if the prognosis is that the child will not continue his formal education beyond the high school level.

Precision teaching is one of the most effective methodologies in the program for specific learning disabilities.

10. Supporting Services

See section on General Procedures.

11. Procedures for Providing Housing for Special Programs

See section on General Procedures.

12. Plans for Evaluation of Program

See section on General Procedures.

APPENDIX C

COMPUTATIONAL SKILLS SURVEY (FORM A)

Directions: Work as many of the exercises as you can. Be sure to work carefully and do what the sign indicates for each exercise. (After you have written the answer for each exercise, write the answer in the blank for the exercise on the right side of the page.)

Name ______________________

1.a.	23 +34	45 +43	b.	54 21 +22	32 15 +42	c.	36 +37	24 +69
d.	347 +472	356 +281	e.	287 +346	169 +559	f.	4,098 +3,924	2,047 +2,965
2.a.	87 -25	96 -43	b.	786 -254	435 -312	c.	84 -26	57 -38
d.	483 -235	564 -427	e.	373 -298	852 -484	f.	4,007 -2,679	8,005 -6,457

Answers

1.a. __________ __________
b. __________ __________
c. __________ __________

d. __________ __________
e. __________ __________
f. __________ __________

2.a. __________ __________
b. __________ __________
c. __________ __________

d. __________ __________
e. __________ __________
f. __________ __________

Answers

3.a. $\begin{array}{r}43\\ \times\ 2\\ \hline\end{array}$ $\begin{array}{r}12\\ \times\ 4\\ \hline\end{array}$ b. $\begin{array}{r}58\\ \times\ 3\\ \hline\end{array}$ $\begin{array}{r}27\\ \times\ 5\\ \hline\end{array}$ c. $\begin{array}{r}375\\ \times\ 45\\ \hline\end{array}$ $\begin{array}{r}267\\ \times\ 76\\ \hline\end{array}$

d. $\begin{array}{r}721\\ \times\ 40\\ \hline\end{array}$ $\begin{array}{r}523\\ \times\ 20\\ \hline\end{array}$ e. $\begin{array}{r}358\\ \times342\\ \hline\end{array}$ $\begin{array}{r}247\\ \times553\\ \hline\end{array}$ f. $\begin{array}{r}721\\ \times508\\ \hline\end{array}$ $\begin{array}{r}831\\ \times407\\ \hline\end{array}$

4.a. $9/\overline{29}$ $8/\overline{35}$ b. $27/\overline{81}$ $48/\overline{96}$ c. $34/\overline{75}$ $19/\overline{81}$

d. $48/\overline{192}$ $57/\overline{342}$ e. $21/\overline{525}$ $38/\overline{684}$

f. $63/\overline{2{,}331}$ $52/\overline{1{,}196}$ g. $193/\overline{5{,}790}$ $161/\overline{6{,}440}$

3.a. ________ ________
b. ________ ________
c. ________ ________

d. ________ ________
e. ________ ________
f. ________ ________

4.a. ________ ________
b. ________ ________
c. ________ ________

d. ________ ________
e. ________ ________

f. ________ ________
g. ________ ________

Adapted from: Brigance, A. H. Brigance diagnostic inventory of essential skills. North Billerica, MA: Curriculum Associates, 1981.

APPENDIX C--Continued

COMPUTATIONAL SKILLS SURVEY (FORM B-1)

Directions: Work as many of the exercises as you can. Be sure to work carefully and do what the sign indicates for each exercise. (After you have written the answer for each exercise, write the answer in the blank for the exercise on the right side of the page.)

1.a.	42	63	b.	32	24	c.	27	36
	+35	+25		41	12		+28	+45
				+13	+52			
d.	238	147	e.	375	264	f.	4,077	3,066
	+581	+692		+163	+362		+2,945	+1,954
2.a.	65	54	b.	897	786	c.	73	62
	-34	-23		-165	-254		-47	-36
d.	271	362	e.	452	541	f.	3,004	4,003
	-152	-243		-374	-463		-1,457	-2,346

Answers

1.a. ____________ ____________
b. ____________ ____________
c. ____________ ____________

d. ____________ ____________
e. ____________ ____________
f. ____________ ____________

2.a. ____________ ____________
b. ____________ ____________
c. ____________ ____________

d. ____________ ____________
e. ____________ ____________
f. ____________ ____________

3.a.	32 x 3	21 x 4	b.	47 x 4	53 x 7	c.	256 x 35	358 x 25
d.	644 x 30	433 x 60	e.	346 x434	465 x363	f.	651 x406	752 x304
4.a.	$8/\overline{26}$	$7/\overline{31}$	b.	$32/\overline{96}$	$14/\overline{56}$	c.	$31/\overline{96}$	$24/\overline{51}$
d.	$37/\overline{185}$	$18/\overline{144}$	e.	$24/\overline{888}$	$43/\overline{817}$			
f.	$54/\overline{1,836}$	$28/\overline{1,568}$	g.	$481/\overline{9,260}$	$172/\overline{5,160}$			

Answers

3.a. ____________ ____________
b. ____________ ____________
c. ____________ ____________

d. ____________ ____________
e. ____________ ____________
f. ____________ ____________

4.a. ____________ ____________
b. ____________ ____________
c. ____________ ____________

d. ____________ ____________
e. ____________ ____________

f. ____________ ____________
g. ____________ ____________

Adapted from: Brigance diagnostic inventory of essential skills. North Billerica, MA: Curriculum Associates, 1981.

APPENDIX C--Continued

COMPUTATIONAL SKILLS SURVEY (FORM B-2)

Directions: Work as many of the exercises as you can. Be sure to work carefully and do what the sign indicates for each exercise. (After you have written the answer for each exercise, write the answer in the blank for the exercise on the right side of the page.)

1.a.	4,003 -2,346	24/51	b.	375 +163	21 x 4	c.	32 51 +13	65 -34
d.	8/26	433 x 60	e.	752 x304	362 -243	f.	24/888	42 +35
2.a.	32/96	3,066 +1,954	b.	265 x 35	62 -36	c.	897 -165	481/9,620
d.	238 +581	465 x363	e.	27 +28	541 -463	f.	37/185	53 x 7

Answers

1.a. ____________ ____________
b. ____________ ____________
c. ____________ ____________

d. ____________ ____________
e. ____________ ____________
f. ____________ ____________

2.a. ____________ ____________
b. ____________ ____________
c. ____________ ____________

d. ____________ ____________
e. ____________ ____________
f. ____________ ____________

3.a.	$28/\overline{1,568}$	$\begin{array}{r}4,007\\ +2,945\\ \hline\end{array}$
b.	$\begin{array}{r}358\\ \times\ 25\\ \hline\end{array}$	$\begin{array}{r}73\\ -47\\ \hline\end{array}$
c.	$\begin{array}{r}786\\ -254\\ \hline\end{array}$	$172/\overline{5,160}$
d.	$\begin{array}{r}147\\ +692\\ \hline\end{array}$	$\begin{array}{r}346\\ +434\\ \hline\end{array}$
e.	$\begin{array}{r}36\\ +45\\ \hline\end{array}$	$\begin{array}{r}452\\ -374\\ \hline\end{array}$
f.	$18/\overline{144}$	$\begin{array}{r}47\\ \times\ 4\\ \hline\end{array}$
4.a.	$\begin{array}{r}651\\ \times 406\\ \hline\end{array}$	$\begin{array}{r}271\\ -152\\ \hline\end{array}$
b.	$43/\overline{817}$	$\begin{array}{r}63\\ +25\\ \hline\end{array}$
c.	$\begin{array}{r}3,004\\ -1,457\\ \hline\end{array}$	$31/\overline{96}$
d.	$\begin{array}{r}264\\ +362\\ \hline\end{array}$	$\begin{array}{r}32\\ \times\ 3\\ \hline\end{array}$
e.	$54/\overline{1,836}$	$7/\overline{31}$
f.	$\begin{array}{r}24\\ 12\\ +52\\ \hline\end{array}$	$\begin{array}{r}54\\ -23\\ \hline\end{array}$
g.	$\begin{array}{r}644\\ \times\ 30\\ \hline\end{array}$	

Answers

3.a. ________ ________
b. ________ ________
c. ________ ________

d. ________ ________
e. ________ ________
f. ________ ________

4.a. ________ ________
b. ________ ________
c. ________ ________

d. ________ ________
e. ________ ________

g. ________ ________

APPENDIX D

SKILL ANALYSIS FOR COMPUTATIONAL SKILLS SURVEY FORMS A AND B

1. Addition of Whole Numbers
    - a. 2 digits without renaming
    - b. 3 digits without renaming
    - c. 2 digits with 1 renaming
    - d. 3 digits with 1 renaming
    - e. 3 digits with 2 renamings
    - f. 4 digits with 3 renamings

2. Subtraction of Whole Numbers
    - a. 2 digits without renaming
    - b. 3 digits without renaming
    - c. 2 digits with 1 renaming
    - d. 3 digits with 1 renaming
    - e. 3 digits with 2 renamings
    - f. 4 digits with 3 renamings

3. Multiplication of Whole Numbers
    - a. 2 digits x 1 digit without carrying
    - b. 2 digits x 1 digit with carrying
    - c. 3 digits x 2 digits with carrying and no zero in multiplier
    - d. 3 digits x 2 digits with carrying and zero in multiplier
    - e. 3 digits x 3 digits with carrying and no zero in multiplier
    - f. 3 digits x 3 digits with carrying and zero in multiplier

4. Division of Whole Numbers
    - a. 2 digits by 1 digit with remainder
    - b. 2 digits by 2 digits without remainder
    - c. 2 digits by 2 digits with remainder
    - d. 3 digits by 2 digits with 1 digit in quotient
    - e. 3 digits by 2 digits with 2 digits in quotient
    - f. 4 digits by 3 digits with no zero in quotient
    - g. 4 digits by 3 digits with zero in quotient

APPENDIX E

OBSERVATION FORM

Name of School ______________________________ Observer ______________________

Student's Name ______________________________ Time Began ____________________

Date ______________________________ Time Ended ____________________

Type of Material (Coop. Comp. Trad.)

Arithmetic operation (+ - x ÷)

Task Oriented Behaviors

____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

Type of Material

Coop. - Cooperative Games Group
Comp. - Competitive Games Group
Trad. - Traditional Worksheet Group

Student Behavior

+ - on-task
- - off-task

APPENDIX F

PROCEDURES USED IN STUDYING COOPERATIVE, COMPETITIVE, AND INDIVIDUALISTIC GOAL STRUCTURES

This study implemented cooperative and competitive conditions in as constructive and effective way possible, based on the procedures used in a series of 12 studies by Johnson and Johnson (1978). Because there were not more than six subjects attending ESE math classes per period in either school used in this study, the researcher modified the competitive games group procedures.

The traditional worksheet has been the regular and ESE teachers' traditional method for remediating arithmetic disabilities, and usually the child follows the procedures outlined by Johnson and Johnson, under individualistic conditions. While the researcher did not use an individualistic condition experimental group, the control group in this study followed the individualistic condition procedures. Thus, the following tables present a review of Johnson and Johnson's procedures for studying cooperative, competitive, and individualistic goal structures. Also, other important information regarding the following studies has been given in Chapter II (also see Table 1).

Procedures Used in Studying Cooperative,
Competitive, and Individualistic Goal Structures

Author(s)	Cooperative Group Instructions	Competitive Group Instructions	Individualistic Group Instructions	Teachers' Instructions	Design and Data Analysis
Johnson, Johnson, & Skon (1979)	Ss instructed to work together as group, completing one paper or set of papers as a group, with all members sharing materials and ideas and helping each other. Make sure each S was involved and agreed on the answers. The teacher praised and rewarded the groups on the basis of each group's achievement.	Ss instructed to compete for 1st, 2nd, 3rd places. After instructional session, Ss were informed of the results and were regrouped. Winners were moved up to a more challenging cluster and the losers were moved to the next lower cluster. This was designed to maintain Ss perceptions that each had a reasonable chance of winning. Although each cluster represented a different level of ability, all Ss worked on the same tasks. Ss instructed to work alone but to be aware of their competitors' progress by noticing when they raised hands	Ss instructed to work alone, to ignore others, and to work at their own place and to do their best work. Ss were separated to minimize distractions. The teacher praised each S individually on the basis of one's own work.	Five months prior to study all Ss had participated in 3 learning situations. Three teachers participated with 30 hrs. training and had used the 3 for 5 months prior to the study. Teachers followed written directions for explaining the tasks and learning conditions, so that instruction was consistent between teachers. The teachers were rotated so that each taught 2 coop., 2 comp., 2 indiv. lessons.	A 1x3 ANOVA with Newman-Kuels post-hoc comparisons among means was used. On the achievement measures the no. of groups was used as the unit of analysis in coop. condition. On the attitude measure the no. of Ss in coop. condition was used as the unit of analysis.

Author(s)	Cooperative Group Instructions	Competitive Group Instructions	Individualistic Group Instructions	Teachers' Instructions	Design and Data Anaylsis
		to signal completion of a task. Ss were seated separately, but near the others in their cluster			
Johnson, Johnson, & Tauer (1979)	Ss were instructed to work together as a group, completing 1 daily assignment sheet as a group, making sure all members were involved and understood how to derive each answer, seeking help and clarification from fellow group members rather than from the teacher, and with the teacher praising and rewarding the group as a whole on the basis of the group score.	To ensure that all Ss in this condition believed they had an equal chance of winning, the clusters competed for 1st, 2nd, 3rd and, in one case, 4th place. On each succeeding day the clusters were changed so that the previous day's 1st place Ss were clustered together, 2nd place Ss were placed in the same cluster, etc. While Ss competed, they were instructed to work alone, attempt to win in their clusters, and seek help and clarification from the teacher	Ss were instructed to work on their own, avoiding interaction with other students, seeking help and clarification from the teacher, and with the teacher praising and rewarding each S individually. Ss were instructed to work at their own pace, doing as much of the assigned material as possible in the time allowed.	Three teachers with 30 hrs. training on how to conduct coop., comp., indiv. lessons spent over 20 hrs. actually teaching using the 3. Each day of the study the 3 teachers met to review their plans for presentation of lesson (strict follow through). All had taught Ss. Teachers briefly reviewed the behavior expected of each S and of the teacher daily and distributed the sheets, Ss in the coop. group were	A 1x3 ANOVA with Newman-Kuels post-hoc comparisons among means. Since both attitude questionnaire and the achievement test were taken individually in all 3 conditions, the no. of Ss in each condition was used as the n.

Author(s)	Cooperative Group Instructions	Competitive Group Instructions	Individualistic Group Instructions	Teachers' Instructions	Design and Data Analysis
		when they needed to. Winners were determined each day and were praised and rewarded by the teacher.		required to sign the paper indicating that they understood how to solve each problem. Each day the teacher would randomly select one S from each group to explain how to solve a problem as a check on whether or not Ss were following and making sure everyone understood how to solve each problem.	
Johnson, Johnson, & Skon (1980)	Ss instructed to work together as a group, sharing materials and ideas, helping each other, and ensuring that each member was involved, agreed on the answers, and learned the material being studied. The teacher praised and rewarded the	Same as Johnson, Johnson, & Skon (1979). Added: The teacher praised and rewarded the winner in each cluster.	Same as Johnson, Johnson, & Skon (1979)	Same as Johnson, Johnson, & Skon (1979)	A 1x3 ANOVA with Newman-Kuels post-hoc comparisons among means. A multivariate was first conducted and when it proved to be significant, univariant analyses were conducted on the dependent variables.

Author(s)	Cooperative Group Instructions	Competitive Group Instructions	Individualistic Group Instructions	Teachers' Instructions	Design and Data Analysis
	groups on the basis of each group's achievement.				
Johnson, Johnson, & Anderson (1976)	Same as Johnson, Johnson, & Tauer (1979)		Same as Johnson, Johnson, & Tauer (1979)	Prior to study all academic instruction was individualized so that students had never been assigned to work on academic learning. During the study Ss participated in no other coop. learning experiences, as all other academic curriculum was individualized. Teachers received 30 hrs training in how to structure and facilitate both coop. and indiv. learning prior to study. Daily observations were made and questionnaires regarding S perceptions of the learning structure was administered twice	Mean responses on measures of altruism and empathy, post-experimental questionnaire, and achievement measures were presented. However, no mention of design and data analysis used.

Author(s)	Cooperative Group Instructions	Competitive Group Instructions	Individualistic Group Instructions	Teachers' Instructions	Design and Data Analysis
				to verify that Ss behavior was in fact appropriate to assigned condition. Ss in coop. studied in group. At the end of period, assignment sheets were scored with no. wrong on each assignment sheet taken as the individual or group score. All members of coop. group received group score. No competition between groups or between persons was structured into the evaluation.	
Johnson, Johnson, & Scott (1978)	Same as Johnson, Johnson, & Skon (1979)		Same as Johnson, Johnson, & Tauer (1979)	Ss had previously studied in both coop. and indiv. ways in other school Ss. In homeroom many had participated in Glasser meetings, and all had done values clarification activities. During the study all students	No mention of design and data analysis. F's reported with alpha set at .11, .01, .001, .05, .10.

Author(s)	Cooperative Group Instructions	Competitive Group Instructions	Individualistic Group Instructions	Teachers' Instructions	Design and Data Analysis
				were participants in both indiv. and coop. learning in other Ss. Teacher explained both goal structures to all Ss the first day. A class discussion was focused on what each required of Ss and teacher. Ss understood the importance of working strictly in their own goal structure and keeping the study controlled and valid as they had all done their own controlled experiments in science.	

APPENDIX G

DESCRIPTIVE DATA

Subject	Age	Sex	Grade	Pretest Score
1	14	M	8	37
2	12	F	7	35
3	13	M	7	34
4	14	M	8	35
5	13	M	7	32
6	11	F	6	30
7	13	M	7	37
8	14	M	8	29
9	14	M	8	34
10	13	M	8	35
11	13	M	7	37
12	12	M	6	30
13	12	M	6	17
14	12	M	6	26
15	12	M	6	23
16	12	M	6	25
17	11	M	6	26
18	15	M	8	28
19	13	M	7	39
20	12	F	7	24
21	12	F	6	15
22	12	M	6	19
23	13	M	7	25
24	14	M	8	26
25	14	F	8	32
26	11	M	6	30
27	14	F	8	23
28	12	M	6	16
29	15	M	8	33
30	15	M	8	33
31	13	M	7	37
32	14	M	8	25
33	12	M	7	30
34	13	M	7	22
35	14	M	8	38
36	13	F	8	21

REFERENCES

Alachua County procedures for providing special education for exceptional students. Gainesville, FL: School Board of Alachua County, Florida, 1981-82.

Allen, L. E., Allen, R. W., & Ross, J. The virtues of nonsimulation games. Simulation and Games, 1970, 1(3), 319-326.

Anderson, R. C. An experiment of behavioral learning in a consumer credit game. Simulation and Games, 1970, 1(1), 43-54.

Bartel, N. Problems in arithmetic achievement. In D. Hammill & N. Bartel (Eds.), Teaching children with learning and behavioral problems (2nd ed.). Boston: Allyn & Bacon, 1978.

Beattie, J. Game drill and traditional drill activities in mathematics with learning disabled and educable mentally retarded adolescents (Doctoral dissertation, University of Florida, 1981). Dissertation Abstracts International, 1981, 42, 0419-4209. (University Microfilms No. ED 8127412)

Boocock, S.S. Instructional games. In Encyclopedia of education. New York: Macmillan, 1969.

Boocock, S. S., & Coleman, J. S. Games with simulated environments in learning. Sociology of Education, 1966, 39(3), 215-236.

Boocock, S. S., & Schild, E. (Eds.). Simulation games in learning. Beverly Hills, CA: Sage, 1968.

Braskamp, L., & Hodgetts, R. The role of an objective evaluation model in simulation gaming. Simulation and Games, 1971, 2(2), 197-210.

Brenton, B. W., & Gilmore, D. An operational definition of learning disabilities (cognitive domain) using WISC Full Scale IQ and Peabody Individual Achievement Test Scores. Psychology in the Schools, 1976, 13(4). 427-432.

Brigance, A. H. Brigance diagnostic inventory of essential skills. North Billerica, MA: Curriculum Associates, 1981.

Brown, V. Learning about mathematics instruction. *Journal of Learning Disabilities*, 1975, *8*(8), 476-485.

Carlson, E. *Learning through games*. Washington, DC: Public Affairs Press, 1969.

Charles, C., & Stadsklev, R. *Learning with games: An analysis of social studies educational games and simulations*. Boulder, CO: Social Sciences Consortium and ERIC Clearinghouse, 1973.

Clark, L. N. Playing around: Benefits, assessments and guidelines for adolescents' educational games. *The Clearing House*, 1978, *52*,(1), 107-110.

Clayton, D. Competition motivates typewriting students. *The Balance Sheet*, 1964, *46*(4), 158-159.

Clifford, M. M. Motivational effects of competition and goal setting in reward and non-reward conditions. *Journal of Experimental Education*, 1971, *39*(3), 11-16.

Cobb, J. A. Relationship of discrete classroom behaviors to fourth grade academic achievement. *Journal of Educational Psychology*, 1972, *63*(1), 74-80.

Coble, C. R., & Brady, G. A. Fun + games = learning. *Science and Children*, 1977, *15*(1), 15-16.

Cooper, J. O. *Measuring behavior* (2nd ed.). Columbus, OH: Charles E. Merrill, 1981.

Cotton, J. L., and Cook, M. S. Meta-analyses and the effects of various reward systems: Some different conclusions from Johnson et al. *Psychological Bulletin*, 1982, *92*(1), 176-183.

Cruickshank, D. R., & Telfer, R. Classroom games and simulations. *Theory into Practice*, 1980, *19*(1), 75-80.

Deutsch, M. Cooperation and trust: Some theoretical notes. In M. Jones (Ed.), *Nebraska Symposium on Motivation*. Lincoln, Nebraska: University of Nebraska Press, 1962, 275-320.

Deutsch, M. The effects of cooperation and competition upon group process. In D. Cartwright & A. Zander (Eds.), *Group dynamics*. Evanston: Row Peterson, 1953.

DeVries, D. Teams-games-tournaments. *Simulation and Games*, 1976, *7*(1), 21-33.

DeVries, D., & Slavin, R. *Effects of team competition on race relations in the classroom.* Paper presented at American Psychological Association Conference, Chicago, Illinois, 1975.

Edwards, K., & DeVries, D. *Learning games and student teams: Effects on attitudes and achievement.* Baltimore: Johns Hopkins University, 1972.

Fisher, J. *Competition and gaming.* Simulation and Games, 1976, *7*(3), 321-328.

Fletcher, J. Evaluation of learning in two social studies simulation games. *Simulation and Games*, 1971, *2*(3), 259-286.

Forness, S. R. *Screening kindergarten children for early intervention through direct observation of classroom behavior.* Los Angeles, CA: California State College, 1973. (ERIC Document Reproduction Service No. ED 088 575)

Gordon, A. K. *Games for growth: Educational games in the classroom.* Palo Alto, CA: Science Research Associates, College Division, 1970.

Hallahan, D. P., Kauffman, J. M., & Ball, D. W. Selective attention and cognitive tempo of low achieving and high achieving sixth grade males. *Perceptual and Motor Skills*, 1973, *36*, 579-583.

Hamblin, R., Buckholdt, D., Ferritor, M., Kozloff, M., & Blackwell, L. *The humanization process.* New York: Wiley Interscience, 1971.

Heitzman, W. *Educational games and simulation: What research says to the teacher.* Washington, DC: National Educational Association, 1974.

Hoffman, R. I. Teaching/learning strategies in the basic subjects. *Instructor*, 1974, *84*(2), 69-70.

Humphrey, J. H. Comparison of the use of active games and language workshop exercises as learning media in the development of language understandings with third grade children. *Perceptual and Motor Skills*, 1965, *21*(1), 23-26.

Humphrey, J. H. An exploratory study of active games in learning of number concepts by first grade boys and girls. *Perceptual and Motor Skills*, 1966, *23*(2), 341-342.

Humphrey, J. H. Active games as a learning medium. *Academic Therapy*, 1969, *5*(1), 15-24.

Inbar, M., & Stoll, C. S. Games and learning. *Interchange*, 1970, *1*(2), 53-61.

Johnson, D.A. Commercial games for the arithmetic class. In S. E. Smith, Jr., & C. A. Backman, *Games and puzzles for elementary and middle school mathematics: Readings from the Arithmetic Teacher*. Reston, VA: National Council of Teachers of Mathematics, 1979.

Johnson, D. J., & Myklebust, H. R. *Learning disabilities: Educational principles and practices*. New York: Grune & Stratton, 1976.

Johnson, D. W., & Ahlgren, A. Relationship between student attitudes about cooperation and competition and attitudes toward schooling. *Journal of Educational Psychology*, 1976, *68*(1), 92-102.

Johnson, D. W., & Johnson, R. T. *Learning together and alone: Cooperative, competitive and individualization*. Englewood Cliffs, NJ: Prentice-Hall, 1975.

Johnson, D. W., & Johnson, R. T. Students' perceptions of and preferences for cooperative and competitive learning experiences. *Perceptual and Motor Skills*, 1976, *42*(3), 989-990.

Johnson, D. W. & Johnson, R. T. Cooperative, competitive, individualistic learning. *Journal of Research and Development in Education*, 1978, *12*(1), 3-15.

Johnson, D. W., Johnson, R. T., & Anderson, D. Student cooperative, competitive, and individualistic attitudes, and attitudes toward schooling. *Journal of Psychology*, 1978, *100*, 183-199.

Johnson, D. W., Johnson, R. T., Johnson, J., & Anderson, D. Effects of cooperative versus individualized instruction on student prosocial behavior, attitude toward learning and achievement. *Journal of Educational Psychology*, 1976, *68*(4), 446-452.

Johnson, D. W., Johnson, R. T., & Scott, L. The effects of cooperative and individualized instruction on student attitudes and achievement. *The Journal of Social Psychology*, 1978, *104*, 207-216.

Johnson, D. W., Johnson, R. T., & Skon, L. Student achievement on different types of tasks under cooperative, competitive and individualistic conditions. *Contemporary Educational Psychology*, 1979, *4*(2), 99-106.

Johnson, D. W., Maruyama, G., & Johnson, R. T. Separating ideology from currently available data: A reply to Cotton and McGlynn. *Psychological Bulletin*, 1982, *92*(1), 186-192.

Johnson, D. W., Skon, L., & Johnson, R. T. Effects of cooperative, competitive and individualistic conditions on problem-solving performance. *American Educational Research Journal*, 1980, *17*(1), 83-93.

Johnson, R. T., Johnson, D. W., & Tauer, M. The effects of comparative, competitive and individualistic goal structures on students' attitudes and achievement. *Journal of Psychology*, 1979, *102*, 191-198.

Johnson, S. W. *Arithmetic and learning disabilities: Guidelines for identification and remediation*. Boston: Allyn & Bacon, 1979.

Keer, D. R., Jr. Mathematics games in the classroom. In S. E. Smith, Jr., & C. A. Backman, *Games and puzzles for elementary and middle school mathematics: Readings from the Arithmetic Teacher*. Reston, VA: National Council of Teachers of Mathematics, 1979.

Kerr, D. R., Jr. Mathematics games in the classroom. *Arithmetic Teacher*, 1974, *21*(3), 172-175.

Kennedy, L. M., & Michon, R. L. *Games for individualizing mathematics learning*. Columbus, OH: Charles E. Merrill, 1973.

Keppel, G. *Design and analysis*. Englewood Cliffs, NJ: Prentice-Hall, 1982.

Kerlinger, F. N., & Pedhazur, E. J. *Multiple regression in behavioral research*. Holt, Rinehart and Winston, 1973.

Kirk, R. E. *Experimental design: Procedures for the behavioral sciences*. Belmont, CA: Brooks/Cole, 1968.

Koppitz, E. M. *Children with learning disabilities: A five-year follow-up study*. New York: Grune & Stratton, 1971.

Lay, M. *The effect of supplementary small group experience on task orientation and cognitive performance in kindergarten children*. Syracuse, NY: Syracuse University, 1969. (ERIC Document Reproduction Service No. ED 039 948)

Lee, R., & O'Leary, A. Attitude and personality effects of a three day simulation. *Simulation and Games*, 1971, *2*(3), 309-348.

Lovinger, S. L. *Learning disabilities and games*. Chicago: Nelson-Hall, 1979.

Lue, M. S. The use of instructional arrangements and their relationship to on-task behaviors with learning disabled, emotionally handicapped, and regular class children (Doctoral dissertation, University of Florida, 1981). *Dissertation Abstracts International*, *42*, 0419-4209. (University Microfilms No. ED 8127448)

Marsh, G. E., Gearheart, C. K., & Gearheart, B. R. *The learning disabled adolescent: Program alternatives in the secondary school*. St. Louis: C. V. Mosby, 1978

McGlynn, R. P. A comment on the Meta-analysis of goal structures. *Psychological Bulletin*, 1982, *92*(1), 184-185.

Mercer, C. D. *Children and adolescents with learning disabilities*. Columbus, OH: Charles E. Merrill, 1979.

Mercer, C. D., & Mercer, A. R. *Teaching students with learning disabilities*. Columbus, OH: Charles E. Merrill, 1981.

Michaels, J. Classroom reward structures and academic performance. *Review of Educational Research*, 1977, *47*(1), 87-99.

Miller, L., & Hamblin, R. Interdependence, differential rewarding, and productivity. *American Sociological Review*, 1963, *28*(5), 768-778.

Nottelmann, E. D., & Hill, K. T. Test anxiety and off task behavior in evaluative situations. *Child Development*, 1977, *48*(1), 225-231.

Otto, W., McMenemy, R. A., & Smith, R. J. *Corrective and remedial teaching*. Boston: Houghton Mifflin, 1973.

Rose, T. L. An investigation of the functional relationship between food additives and hyperactivity (Doctoral dissertation, University of Florida, 1977). *Dissertation Abstracts International*, 1977, *25*, 2485-2486A. (University Microfilms No. ED 14243)

Sharan, S. Cooperative learning in small groups: Recent methods and effects on achievement, attitudes, and ethnic relations. *Review of Educational Research*, 1980, *50*(2), 241-171.

Slavin, R. A. A student team approach to teaching adolescents with special emotional and behavioral needs. *Psychology in the Schools*, 1977, *14*(1), 77-84.

Smith, S. E., Jr., & Backman, C. A. *Games and puzzles for elementary and middle school mathematics: Readings from the Arithmetic Teacher*. Reston, VA: National Council of Teachers of Mathematics, 1975.

Sparks, S. S. The relation of off-task behavior to performance among educable mentally retarded, learning disabled, and normal middle school students (Doctoral dissertation, University of Florida, 1981). *Dissertation Abstracts International*, *42*, 0419-4209. (University Microfilms No. ED DA8203723)

Stodolsky, S. S. Ecological features of fifth-grade math and social studies classes and their relation to student involvement. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, April, 1979.

Traffel, S. Choosing special academic activities as a reward for increased academic productivity. In T. Brigham (Ed.), Behavior analyses in education: Self-control and reading. Dubuque, IA: Kendall-Hunt, 1976.

Wallace, G., & McLoughlin, J. A. Learning disabilities: Concepts and characteristics. Columbus, OH: Charles E. Merrill, 1979.

Zieler, R. Games for school use. Westchester County, NY: Board of Cooperative Educational Services, 1968.

BIOGRAPHICAL SKETCH

Shelia Yvette Smalley is the daughter of William T. Smalley and Juanita M. Smalley. Born in Ocala, Florida, on December 25, 1952, she graduated from Leesburg High School in Leesburg, Florida. From 1969 to 1972 she attended Bethune-Cookman College and was awarded a B.S. degree in Psychology. She received her M.Ed. degree from the University of Florida in Gainesville, Florida, in 1974.

Shelia has had a variety of educational experiences. She has served as teacher, director of child care services, education coordinator/curriculum specialist, assistant professor of education/area advisor for elementary education majors, early childhood consultant, consultant for visiting committees for school evaluation, and consultant for vocational, middle, primary, and preschool programs.

Shelia's consultantships and leadership are not limited to education. She is an ordained minister, serving at the Church of the Living God (CLG) in Leesburg, Florida, and she is president of the CLG Florida State Youth Congress.

In August, 1980, she moved to Gainesville, Florida, and enrolled in the doctoral program in special education at the University of Florida. She is a member of Zeta Phi Beta Sorority, the Council for Exceptional Children, and Phi Delta Kappa.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Cecil D. Mercer

Cecil D. Mercer, Chairman
Professor of Special Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Robert F. Algozzine

Robert F. Algozzine
Professor of Special Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Myron A. Cunningham
Professor Emeritus of Special
Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

James W Longstreth

James W. Longstreth
Associate Professor of Educational
Administration and Supervision

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Catherine Morsink

Catherine V. Morsink
Professor of Special Education

This dissertation was submitted to the Graduate Faculty of the Department of Special Education in the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1982

Dean for Graduate Studies and Research

UNIVERSITY OF FLORIDA
3 1262 08556 9399